ENVIRONMENTAL PROTECTION AGENCY
TECHNICAL ENFORCEMENT SUPPORT
AT
HAZARDOUS WASTE SITES

TES IV
CONTRACT NO. 68-01-7351
228
EPA WORK ASSIGNMENT NO.R07008
ACC. 2
JACOBS WORK ASSIGNMENT NO. 863.
FINAL
RCRA FACILITY ASSESSMENT REPORT
COLLIS INCORPORATED
CLINTON, IOWA

U.S. EPA REGION VII

PREPARED BY
JACOBS ENGINEERING GROUP INC.
12600 WEST COLFAX AVENUE, SUITE A300
LAKEWOOD, COLORADO 80215

OCTOBER 28, 1988

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JACOBS ENGINEERING GROUP INC.
ENVIRONMENTAL SYSTEMS DIVISION

12600 WEST COLFAX AVENUE, SUITE A300, LAKEWOOD, COLORADO 80215
TELEPHONE (303) 232-7093

October 28, 1988

Mr. Gene Evans
U.S. EPA Region VII
726 Minnesota Avenue
Kansas City, KS 66101

Re: **Final RCRA Facility Assessment Report for Work Assignment No. 863 (EPA No. R07008)**

Dear Mr. Evans:

Enclosed please find two copies of the Final RCRA Facility Assessment Report for Collis Inc. completed in fulfillment of TES IV Work Assignment No. 863 (EPA No. R07008).

If you have any questions concerning the Final RCRA Facility Assessment Report, please do not hesitate to call me at (303) 232-7093.

Sincerely,
JACOBS ENGINEERING GROUP INC.

Neil Bingert

Neil Bingert
Work Assignment Manager

cc: (without enclosure)
S. Houser, Jacobs Region VII
D. Fletcher, Jacobs Region VII
P. Eager, EPA Region VII

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1.0 INTRODUCTION

The primary objective of the RCRA corrective action program is to clean up releases of hazardous wastes or hazardous constituents that threaten human health or the environment. The program applies to all operating, closed, or about to be closed RCRA facilities.

In order to implement corrective action requirements, the U.S. Environmental Protection Agency (EPA) must first determine the existence or likelihood of a release by means of a RCRA Facility Assessment (RFA). The RFA is a three-stage process for:

- Identifying and gathering information on releases at RCRA facilities;
- Evaluating solid waste management units (SWMUs) and other areas of concern for releases to all media and regulated units for releases to media other than ground water;
- Making preliminary determinations regarding releases of concern and the need for further actions and interim measures at the facility; and
- Screening from further investigation those SWMUs which do not pose a threat to human health or the environment.

The three stages of the RFA requiring the collection and analysis of data to support initial release determinations include:

- The mandatory preliminary review (PR) which focuses primarily on evaluating existing data and information;
- The mandatory visual site inspection (VSI) which entails the on-site collection of visual information to obtain additional evidence of releases; and
- The optional sampling visit (SV) to fill data gaps that remain upon completion of the PR and VSI by obtaining sampling and field data.

This document summarizes information collected by Jacobs Engineering Group Inc. (Jacobs) from the PR and VSI of the Collis Inc. (Collis) electroplating facility in Clinton, Iowa. An SV was not conducted at the Collis facility. The characteristics of each SWMU and the waste(s) contained in each SWMU located at the Collis facility have been assessed in conjunction with associated migration pathways, evidence of releases, and exposure potential. The sufficiency of the information gathered and the need for further action are discussed.

The PR was conducted by reviewing information contained in EPA Region VII and Iowa Department of Water, Air, and Waste Management (IDWAWM) files pertaining to the Collis facility. Document sources included the following:

- Site characterization and hydrogeologic assessment reports;
- Ground water, soil, and waste analyses results;
- Facility inspection reports;
- Closure and post-closure plans; and
- Correspondence.

Information from these sources was used to identify and characterize the SWMUs and potential releases and to focus the activities conducted during the VSI. The VSI was then completed August 23 and 24, 1988. A complete list of all documents referenced and a copy of the photographs from the VSI are included in Section 8.0 and Appendix 1, respectively. Throughout this report, documents are referenced by numbers keyed to the reference list in Section 8.0.

2.0 FACILITY DESCRIPTION AND HISTORY

2.1 Location Description and Production History

Collis Inc., EPA I.D. No. IAD047303771, is located at 2005 South 19th Street in Clinton, Iowa. The plant is bounded to the north by a railroad track right-of-way, Manufacturer's Ditch, and cultivated land. South 19th Street bounds the Collis property to the west beyond which lie both forested and cultivated areas. The facility abuts a small residential development to the south and the Clinton Country Club golf course to the east. Overall, the Collis property contains approximately 12.5 acres. The facility lies to the southwest of the City of Clinton (population 35,000), about two miles from the center of town. Figure 1 shows the facility's general location and Figure 2 is a map of the plant itself.

Collis was started by O.D. Collis in Dubuque, Iowa who moved the facility to its current location in Clinton about 1915. The plant was constructed in a building which had previously been used for the manufacture of wagon wheels. The facility initially manufactured ornamental iron and metal products for the agriculture industry. In 1964, interest in the facility was sold to Chamberlain Manufacturing Corporation who began the current production of refrigerator shelving items. The president of Chamberlain Manufacturing Corporation, John P. Sommers, resigned and purchased the Collis Division in 1984, thus forming Collis Inc. The facility currently employs over 300 people and operates three shifts per day, five to six days per week.

Since 1964, the Collis facility has been involved in assembling and electroplating primarily refrigerator shelving items and wire baskets. Initially, the plant utilized three zinc-cyanide plating lines and one nickel-chrome plating line. Nickel-chrome plating was discontinued in 1972 due to the excessive costs involved. In 1983, Collis added an epoxy powder coating line to the finishing process. By December 1985, the facility had converted all zinc-cyanide plating lines to a zinc-chloride process. Currently, the facility operates four zinc-chloride plating lines and the one epoxy powder coating line. A more detailed description of the manufacturing processes, and of the wastes generated by those processes, follows in Section 2.2.

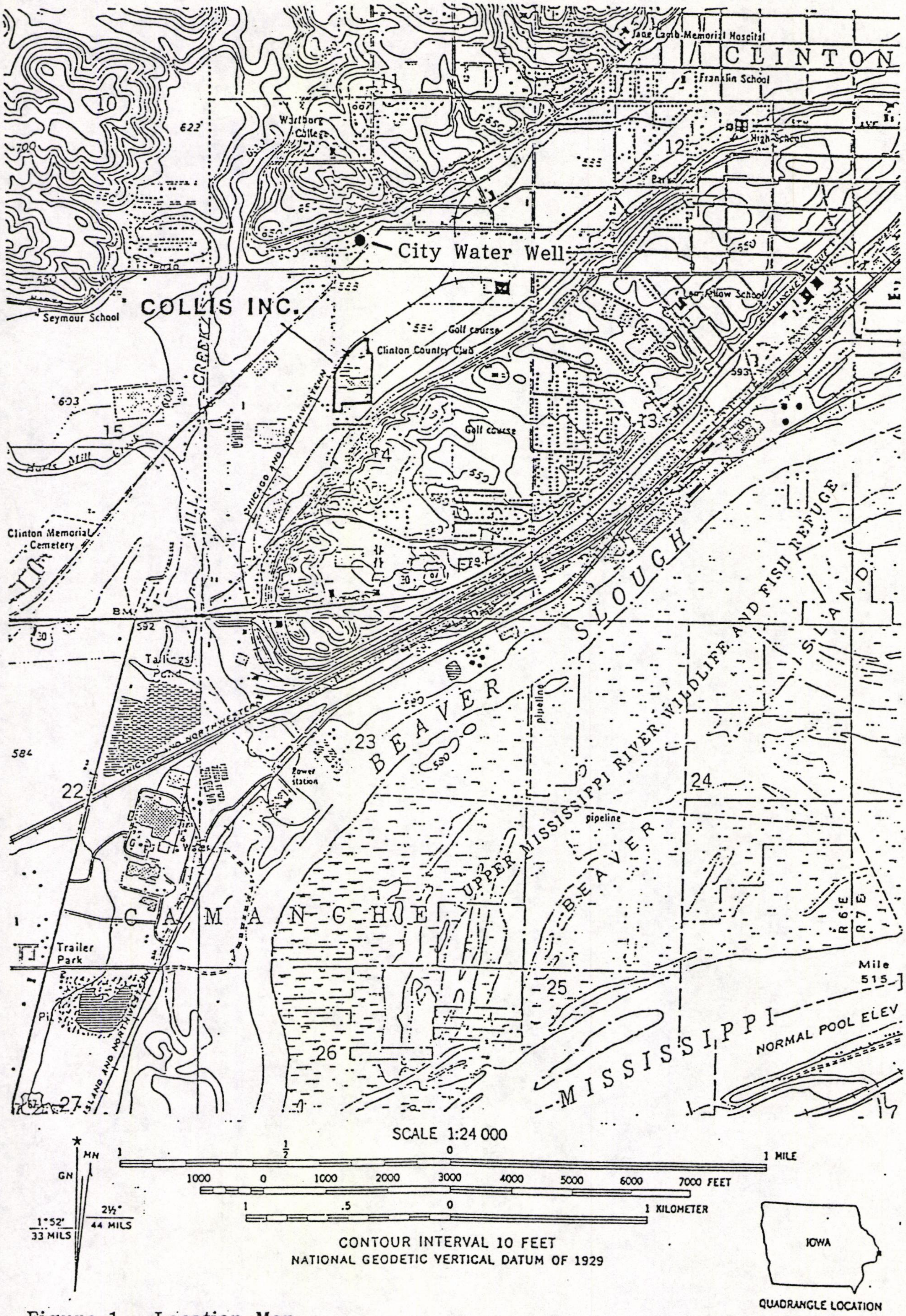


Figure 1. Location Map.

Source: USGS 7.5 minute quadrangle map entitled "Clinton, Iowa-Ill.," 1953, photorevised 1976.

Legend

1. Acid Storage Tank
2. Cleaner Storage Tank
3. Settling Basin
4. Temporary Storage Tank
5. Filter House
6. Sludge Impoundments
   - - - - outline of original impoundments
   - ——— area currently excavated
7. Chemical Storage Area
8. Receiving Dock Inside Storage Area
9. Receiving Dock Outside Storage Area
10. Spent Chromic Acid Tank
11. Pretreatment Tanks Area
12. Nitric Acid Storage Tank
13. HCl Acid Storage Tank
14. Zinc Storage Tank
15. Epoxy Lacquer Tanks

• Current Monitoring Well Locations

o Selected Additional Well and Borehole Locations

⟶ Surface Drainage

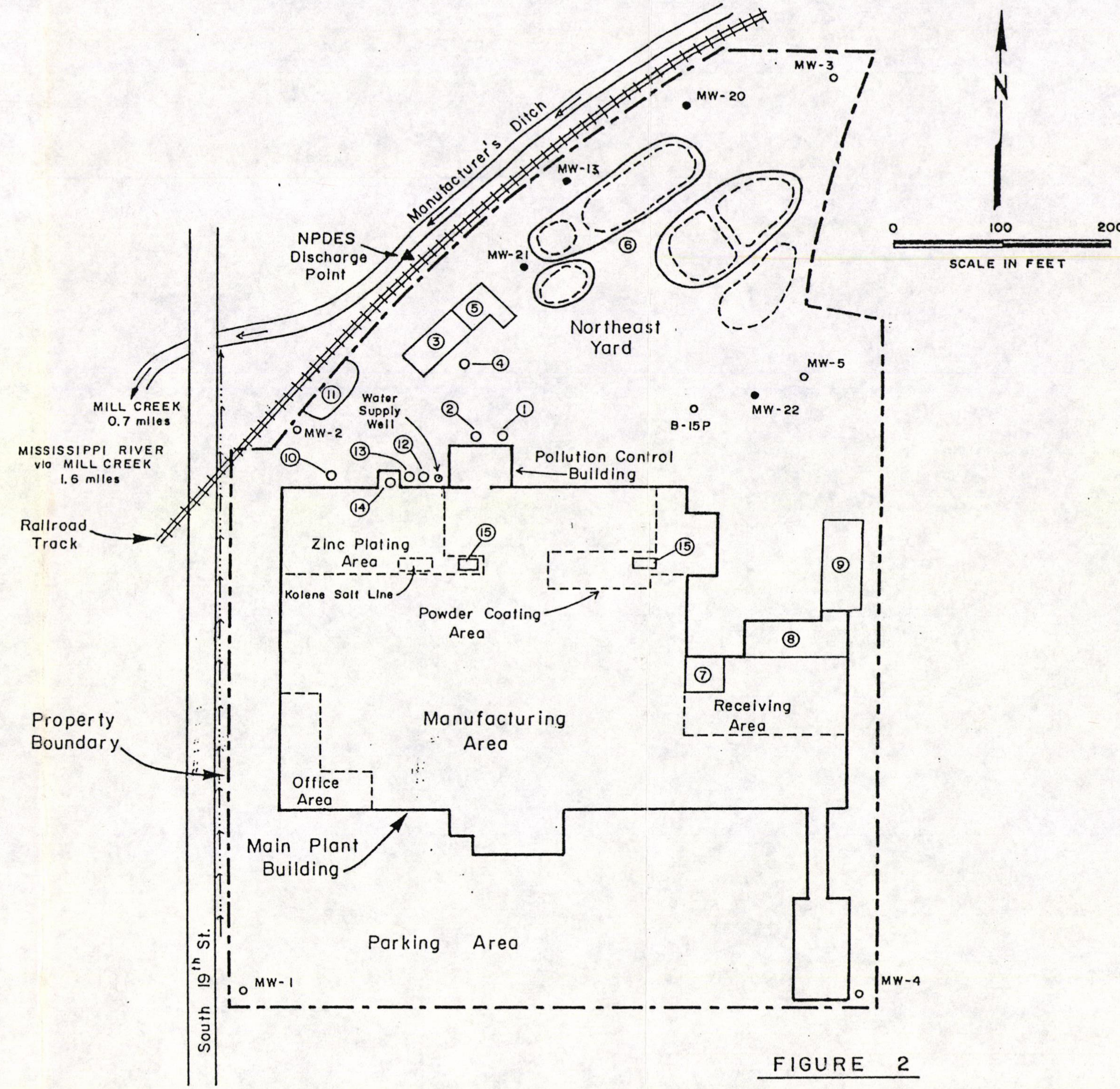


FIGURE 2

Collis Inc., Facility Map

Source: Adopted from maps supplied by Collis, Inc.

JACOBS ENGINEERING GROUP INC.

2.2 Process Description and Waste Generation

This section describes the various manufacturing processes employed at Collis and briefly identifies the waste streams generated during the manufacturing steps. A more detailed description of the facility's waste management practices and of the characteristics of those units used to manage the plant's waste streams follows in Section 4.0.

Collis manufactures refrigerator shelving items from rolled carbon steel and wire stock and some preformed steel sections. The bulk steel materials, obtained from local suppliers, are cut to size, assembled, and welded using a resistance welding technique. Once assembled, the products are finished in one of four zinc electroplating lines or in the epoxy powder coating line.

The four zinc electroplating lines all operate using the same basic immersion type processes. Initially, the assembled shelving items are run through a series of caustic alkaline soak cleaning baths, reverse current electrode caustic cleaning baths, and counter-flow cold water rinses. The parts are then placed in an acid pickle bath containing 50 percent hydrochloric (HCl) acid by volume for rust removal. Following another series of caustic cleaning baths and water rinses, the parts are then placed in a second reduced acid (10 percent HCl by volume) pickle bath followed by a water rinse.

The shelving items are then ready for immersion in the zinc electroplating bath. The zinc plating tanks contain a solution composed of zinc-chloride, boric acid, and potash with solid zinc balls, held in netting, lining the inside perimeter of the tanks. Most of the zinc plated to the parts comes from the solid zinc balls which act as the anodes in the electroplating process. Zinc-chloride is added to the tank solution only about once or twice a year. Collis has utilized the zinc-chloride based electroplating process since December 1985. Prior to this, the facility employed a zinc-cyanide based process.

Following the zinc electroplating process, the shelving items are run through another series of cold water counter flow rinses before immersion in the chromate tank. The chromate tank contains an aqueous formulation of chromic acid and fluoride. The parts may or may not be dipped in a nitric acid pickle tank (0.25 percent nitric acid by volume) prior to immersion in the chromate tank depending upon the specifications of a particular product run. The concentration of chromium in the chromate bath is currently maintained at about 200 milligrams per liter (mg/l). Prior to conversion to the zinc-chloride based electroplating solution, however, the concentration of chromium was maintained at about 75 grams per liter (g/l).

Following the chromate dip, the parts are then water rinsed, immersed in a sodium metasilicate bath, and rinsed again in preparation for immersion in a clear epoxy lacquer bath. The epoxy lacquer is occasionally thinned with a solvent to maintain a proper consistency. The epoxy lacquer is then oven-dried before packaging and shipping of the finished products.

Some of the shelving items manufactured at the Collis facility are finished by an epoxy powder coat method. Currently, epoxy powder coating represents about 55 percent of Collis' business. The epoxy powder coat line begins with the washer unit where a caustic alkaline cleaning solution is sprayed-on the shelving items followed by a sprayed-on water rinse. The shelving items are also coated with a sprayed-on iron phosphate solution followed by a sprayed-on chromate solution, all within the washer unit.

After exiting the washer unit, the shelving items are immersed in a clear epoxy lacquer bath identical to the epoxy lacquer bath utilized on the zinc plating lines. The epoxy lacquer is dried in an oven prior to the parts being sent to the powder coating room. There, an extruded epoxy powder is electrostatically applied to the shelving items. The shelving items are then returned to the oven where the applied powder is melted and fused to the units. The final procedure in the powder coating process is an inspection and touch-up with epoxy paint prior to packaging and shipping.

Off-specification shelving items from both the zinc plating and powder coating processes are stripped in the kolene salt line, located in the zinc plating area. The off-spec parts are initially immersed in a molten kolene salt solution (90 percent caustic soda with sodium nitrate) which removes the epoxy lacquer or epoxy powder coat finish. Following a water rinse, the shelving items are dipped in an HCl acid solution to remove any remaining zinc or chromate. Another water rinse and immersion in a caustic alkaline cleaning solution which neutralizes any remaining HCl acid then follows. Finally, the stripped shelving items are dipped in oil to inhibit rust formation before being returned to either the zinc plating or powder coating lines.

Wastes generated during the assembling process include scrap metal, spent lube oil, hydraulic oil, cooling oil, and an oil coating from the bulk steel raw materials. All scrap metal is collected in a dumpster and periodically recycled. Approximately one 55-gallon drum of waste oil is generated each month which is sold to a local reclamation facility.

Wastes generated from the zinc plating lines include spent caustic cleaner and rinse waters, spent HCl acid pickle solutions, spent chromate solution, spent sodium metasilicate solution, and, when utilized, spent nitric acid pickle solution. All wastes are dumped into floor drains adjacent to the plating lines. Any sludges which accumulate in the immersion tanks are flushed out with the aqueous solutions into the floor drain system. The waste streams dumped into the floor drain system are collected in sumps for transfer to the wastewater treatment plant (WWTP) via an overhead pipe system.

The epoxy lacquer tanks reportedly do not generate a waste stream. The zinc electroplating tanks also have not generated a waste stream since the conversion to the zinc-chloride based plating process completed in December 1985. Prior to this conversion, the zinc-cyanide based plating process resulted in the accumulation of sludges in the bottom of the electroplating tanks. The electroplating tanks were cleaned about once a year, generating about 20 drums of sludge from each plating tank which were disposed off-site.

Wastes generated from the epoxy powder coat line include spent caustic cleaner and rinse waters, spent iron-phosphate solution, and spent chromate solution, all from the washer unit. All wastes generated are collected in floor drains consisting of open troughs in the concrete floor covered with metal grates. The waste streams are diverted to a sump from which they are pumped to the WWTP through the overhead pipe system. No wastes are generated from the powder coat room or from the epoxy lacquer tank.

Wastes generated from the kolene salt line include spent kolene salts, spent caustic alkaline cleaner and rinse waters, and spent HCl acid solution. The spent kolene salts are allowed to cool and harden before transport to the WWTP as solid bricks. The spent caustic alkaline solution, rinse waters, and spent acid are drained to the same floor drain and sump system used on the zinc plating lines.

The facility currently discharges about 147,000 gallons per day (gpd) of wastewater effluent following treatment in the WWTP [34]. The wastewater is discharged to Manufacturer's Ditch through an NPDES regulated outfall (Figure 2). Facility personnel, questioned during the VSI, indicated that the amount of effluent discharged has been nearly halved since the 1970's primarily through the recirculation of water in the plating tanks, use of the counter-flow rinse process, and the diversion of all non-contact cooling water and boiler blowdown water from the WWTP. All non-contact cooling water (water used to cool the manufacturing equipment) and boiler blowdown water is currently discharged directly to Manufacturer's Ditch through an effluent pipe located adjacent to the NPDES discharge point. The facility has recently applied to the state for an NPDES permit for this discharge [35]. The WWTP generates about 15 to 20 cubic yards of sludge per week [30] which is currently transported for off-site disposal. A more detailed discussion of the facility's historical waste management practices and descriptions of the individual SWMUs which comprise the WWTP follows in Sections 2.3 and 4.0, respectively.

2.3 Waste Management History

According to facility personnel, questioned during the VSI, Collis began construction of the WWTP to manage their industrial effluent in 1970. The facility also received their first effluent permit limitations from the State of Iowa for discharge into Manufacturer's Ditch in 1970 [2]. The facility currently continues use of this permitted outfall for the disposal of their treated wastewater effluent. Facility personnel, questioned during the VSI, were unsure of how the industrial wastewater was managed between the time Chamberlain Manufacturing Corporation first took over the plant in 1964 and construction of the WWTP in 1970, but speculated that the untreated effluent was probably discharged directly to Manufacturer's Ditch. Prior to 1964, facility personnel were uncertain of the products manufactured, the waste streams generated, or of how the waste streams might have been managed.

The initial WWTP, constructed in 1970, included systems for the destruction of chrome and cyanide, a neutralization unit, and a settling basin for the separation of solids. The system utilized a batch treatment method and included five unlined surface impoundments excavated in 1970 for disposal of the final sludge. The impoundments were also used to hold water and sludges during annual plant shutdowns for cleanup and maintenance [25]. According to facility personnel, questioned during the VSI, the WWTP was then modified in 1976 with the installation of an in-line, continuous chrome and cyanide destruction system. By 1979, the facility had ceased deposition of sludges in the surface impoundments and was containerizing the sludges for off-site disposal [25].

In 1979, the State of Iowa adopted a water quality standard of 0.005 mg/l total cyanide for Class B waters, a far more stringent limitation than the 0.3 mg/l total cyanide limit imposed by Collis' NPDES permit at that time [17]. Mill Creek, a tributary of the Mississippi River which received the facility's wastewater effluent via Manufacturer's Ditch, was designated a Class B water [17]. A site specific cyanide study in Mill Creek was then completed May 1, 1983, which concluded that the 1979 water quality standard for cyanide was appropriate and should be utilized in developing effluent limits for the facility's new NPDES permit [13]. The new NPDES permit, with a 0.01 mg/l total cyanide limitation, was subsequently issued September 27, 1984 [21]. The new limitation was to become effective April 1, 1985 [21].

To comply with the more stringent NPDES total cyanide limitation, Collis committed to adapting to a non-cyanide based plating process [24]. Change-over of the four plating lines to a zinc-chloride process was completed by December 1985 [27]. Adaption to the non-cyanide plating process ended Collis' generation of the F006, F008, and F009 RCRA hazardous wastes listed on the facility's original Notification of Hazardous Waste Activity and a revised Part A permit application [36]. According to facility personnel, questioned during the VSI, the change-over also allowed Collis to decrease the chromium concentration used in the chromate bath from 75 g/l to 200 mg/l. The WWTP sludge, consequently, no longer displayed the hazardous waste characteristic of EP toxicity for chrome [32]. A recent EPA RCRA compliance inspection has concluded that Collis currently does not generate any RCRA hazardous wastes [39].

The facility was initially compelled to investigate the effects of past waste management practices, primarily sludge disposal in the WWTP unlined surface impoundments, in an Agreed Findings and Order on Consent dated January 24, 1983 [12]. The order specified a two-phased study which consisted of a hydrogeologic investigation, ground-water monitoring and analysis, and a determination of the need for additional shallow and deep ground-water monitoring wells. Currently, Collis continues efforts to remediate the inactive sludge disposal impoundments.

3.0 ENVIRONMENTAL SETTING

3.1 Climate

The climate of the Clinton, Iowa area, location of Collis Inc., is continental temperate with moderately cold winters and moderately hot and humid summers. The average January temperature is 19.5^{o}F while the average July temperature is 74.4^{o}F. Yearly precipitation averages 35.78 inches. August, averaging 4.46 inches, is the wettest month. A summary of all average and extreme monthly temperatures and precipitation data for Clinton, Iowa is shown in Table 1.

3.2 Topography and Drainage

The Collis facility is located on relatively flat and level terrain which rises slightly toward the southeast from an area south of the main plant building. Surface elevations range from a low of about 584 feet near the northeast corner of the site, to a high of about 594 feet near the southeast corner.

CLIMATOGRAPHY OF THE UNITED STATES NO. 20

CLINTON, IA

PERIOD: 1951-80
ELEVATION: 595 FT

CLIMATOLOGICAL SUMMARY

	TEMPERATURE (F)															PRECIPITATION TOTALS (INCHES)											
	MEANS			EXTREMES						MEAN NUMBER OF DAYS				DEGREE DAYS								SNOW			MEAN NUMBER OF DAYS		
										MAX		MIN															
	* DAILY MAXIMUM	* DAILY MINIMUM	* MONTHLY	RECORD HIGHEST	YEAR	DAY	RECORD LOWEST	YEAR	DAY	90 AND ABOVE	32 AND BELOW	32 AND BELOW	0 AND BELOW	* HEATING BASE 65	* COOLING BASE 65	* MEAN	# GREATEST MONTHLY	YEAR	GREATEST DAILY	YEAR	DAY	MEAN	MAXIMUM MONTHLY	YEAR	.10 OR MORE	.50 OR MORE	1.00 OR MORE
JAN	28.1	10.9	19.5	62+	67	24	-26+	70	21	0	18	30	8	1411	0	1.59	4.92	60	2.18	60	12	9.2	32.9	79	4	1	0
FEB	34.0	16.2	25.1	69+	76	27	-24+	79	5	0	12	26	4	1117	0	1.27	2.81	71	1.46	74	22	6.3	22.2	60	3	1	0
MAR	45.1	26.5	35.9	82+	78	31	-14+	60	6	0	4	23	0	902	0	2.68	6.56	76	2.77	76	04	6.5	19.5	65	6	2	0
APR	61.5	39.4	50.5	94	52	29	9+	75	4	0	0	8	0	435	0	3.70	7.46	73	3.00	73	21	.9	7.5	75	7	2	1
MAY	73.1	50.2	61.7	93+	78	27	28+	66	10	1	0	1	0	164	62	3.82	8.64	74	3.00	74	17	.0	.0		7	3	1
JUN	81.7	59.6	70.7	99+	71	19	38+	72	11	5	0	0	0	18	189	4.27	8.66	73	4.80	73	17	.0	.0		7	3	1
JUL	85.1	63.8	74.4	100+	55	30	45+	71	30	7	0	0	0	0	296	3.85	8.61	61	4.53	63	19	.0	.0		6	3	1
AUG	83.2	61.7	72.5	100	53	31	41+	58	25	5	0	0	0	6	238	4.46	10.32	79	4.00	67	07	.0	.0		7	3	1
SEP	76.0	53.2	64.6	100+	53	1	30+	75	26	2	0	0	0	84	72	3.33	11.70	61	6.50	61	13	.0	.0		5	2	1
OCT	65.0	42.3	53.7	92	53	2	17+	69	28	0	0	5	0	365	15	2.68	6.00	54	3.55	54	10	.2	4.0	67	5	2	0
NOV	48.1	29.8	39.0	76+	78	4	-8+	77	26	0	3	19	0	780	0	2.12	4.76	52	3.39	52	17	1.7	6.5	59	4	1	0
DEC	34.2	18.3	26.3	68	70	3	-27+	63	21	0	13	28	3	1200	0	2.01	4.95	57	2.05	71	15	8.1	27.9	51	4	1	0
YEAR	59.6	39.3	49.5	100	SEP 53	1	-27	DEC 63	21	20	50	140	15	6482	872	35.78	11.70	SEP 61	6.50	SEP 61	13	32.9	32.9	JAN 79	65	24	6

*FROM 1951-80 NORMALS

ESTIMATED VALUE BASED ON DATA FROM SURROUNDING STATIONS

+ ALSO ON EARLIER DATES.

DEGREE DAYS TO SELECTED BASE TEMPERATURES (F)

BASE BELOW	HEATING DEGREE DAYS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
65	1411	1117	902	435	164	18	0	6	84	365	780	1200	6482
60	1256	977	747	297	84	0	0	0	24	237	630	1045	5297
57	1163	893	662	220	46	0	0	0	9	176	540	952	4661
55	1101	837	602	176	30	0	0	0	0	142	480	890	4258
50	946	697	461	91	9	0	0	0	0	68	343	735	3350

BASE ABOVE	COOLING DEGREE DAYS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
55	0	0	10	41	237	471	601	543	293	101	0	0	2297
57	0	0	7	25	192	411	539	481	237	73	0	0	1965
60	0	0	0	12	136	325	446	388	162	42	0	0	1511
65	0	0	0	0	62	189	296	238	72	15	0	0	872
70	0	0	0	0	21	90	162	113	19	0	0	0	405

DERIVED FROM THE 1951-80 MONTHLY NORMALS

PROBABILITY THAT THE MONTHLY PRECIPITATION WILL BE EQUAL TO OR LESS THAN THE INDICATED PRECIPITATION AMOUNT

MONTHLY PRECIPITATION (INCHES)

PROBABILITY LEVELS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
.05	.40	.29	.55	1.55	1.40	1.53	1.35	.83	.38	.00	.46	.51
.10	.55	.40	.80	1.89	1.76	1.93	1.71	1.22	.64	.50	.65	.70
.20	.78	.59	1.19	2.36	2.28	2.51	2.24	1.88	1.10	1.04	.96	.99
.30	.99	.76	1.55	2.75	2.71	3.00	2.69	2.48	1.56	1.46	1.25	1.25
.40	1.19	.93	1.91	3.11	3.12	3.46	3.11	3.10	2.06	1.88	1.53	1.50
.50	1.40	1.10	2.30	3.48	3.54	3.94	3.55	3.77	2.61	2.31	1.83	1.77
.60	1.64	1.30	2.74	3.88	4.00	4.46	4.02	4.52	3.26	2.80	2.17	2.07
.70	1.92	1.54	3.26	4.33	4.53	5.07	4.58	5.44	4.07	3.35	2.58	2.43
.80	2.29	1.86	3.96	4.91	5.20	5.84	5.29	6.65	5.16	4.10	3.11	2.89
.90	2.87	2.36	5.07	5.79	6.25	7.03	6.39	8.61	6.97	5.30	3.97	3.63
.95	3.42	2.83	6.12	6.59	7.20	8.13	7.39	10.47	8.72	6.44	4.78	4.32

THESE VALUES WERE DETERMINED FROM THE INCOMPLETE GAMMA DISTRIBUTION.

Table 1.
Clinton Climatological Data
Source: Supplied by Iowa State Climatologist

Surface drainage in the northern half of the site is generally to the north or northwest, eventually draining into Manufacturer's Ditch. The drainage pattern is poorly developed on the relatively flat terrain and several areas of standing water from recent precipitation were observed during the VSI. Stormwater runoff from the roof of the plant building is collected in a storm sewer and discharged to Manufacturer's Ditch through a culvert located beneath the South 19th Street bridge.

The south half of the site drains toward the west-northwest and is intercepted by a drainage ditch adjacent to South 19th Street. This drainage flow enters Manufacturer's Ditch next to the South 19th Street bridge. Manufacturer's Ditch flows southwest approximately 3,500 feet to Mill Creek. During the VSI, it was observed that the water in Manufacturer's Ditch was virtually stagnate and covered with green algae. Mill Creek flows to the south and southeast approximately 5,000 feet into Beaver Slough which is part of the Mississippi River.

3.3 Regional Geology/Hydrogeology

Clinton, Iowa is located in Clinton County along the central part of the eastern boundary of Iowa on the Mississippi River. Clinton County is divided into several major areas of distinct physiography. These physiographic areas include the Kansan-Nebraskan Glacial Till Plain, the Iowa Erosional Surface, and alluvial flood plains associated with the Mississippi River, the Wapsipinicon River, and the Goose Lake Channel [14]. The Collis facility is located on a portion of the Mississippi River flood plain which is currently drained by Manufacturer's Ditch and Mill Creek. The area is dominated by nearly flat, moderately well drained to poorly drained soils of the Colo and Sawmill Series [14]. These soils are formed in silty alluvium on flood plains.

Within east-central Iowa, there are three separate surficial aquifers and five bedrock aquifers available for use as water supplies [3]. Table 2 shows the regional stratigraphy and hydrologic units of east-central Iowa. The surficial aquifers are located within the unconsolidated materials above the bedrock surface. They are subdivided into alluvial, buried-channel, and drift aquifers. The alluvial aquifers are located along present day watercourses. They consist of sands and gravels interbedded with less-permeable silts and clays and lie beneath the flood plains of larger rivers and creeks. The buried channel aquifers are the unconsolidated material deposited by ancient streams that carved valleys prior to or between glacial advances. The drift aquifers are irregularly occurring beds of sand and/or gravel that are within the glacial drift.

The five major bedrock aquifers in east-central Iowa include (in descending order) the Mississippian aquifer, the Devonian aquifer, the Silurian aquifer, the Cambrian-Ordovician aquifer, and the Dresbach aquifer (Table 2). The Silurian aquifer is the shallowest bedrock aquifer in the Clinton area [3]. This aquifer consists mostly of dolomite with some limestone. The Cambrian-Ordovician aquifer is separated from the overlying Silurian aquifer by a thick sequence of shale and dense dolomite of the Ordovician confining beds. The Cambrian-Ordovician aquifer is predominantly dolomite; however, two sandstone beds occur within the aquifer. The lower one, the Jordan Sandstone, is the principal water-bearing unit of the Cambrian-Ordovician aquifer. Underlying the Cambrian-Ordovician aquifer, and separated from it by Cambrian confining beds, is the Dresbach aquifer. The Dresbach aquifer consists chiefly of sandstone.

Table 2. — Hydrologic units in east-central Iowa

Hydrologic unit	General thickness in feet	Age of rocks	Name of rock units	Type of rock
Surficial aquifers alluvial buried-channel drift	0 to 400	Quaternary (0 to 1 million years old)	Quaternary deposits, undifferentiated	Sand, gravel, silt, and clay Sand, gravel, silt, and clay Till (sandy, pebbly clay) sand, and silt
Pennsylvanian rocks principally confining beds; locally contains waterbearing sandstone	0 to 70	Pennsylvanian (280 to 310 million years old)	Pennsylvanian rocks, undifferentiated	Shale, sandstone, limestone, and coal
Mississippian aquifer	0 to 220	Mississippian (310 to 345 million years old)	Meramecian Series Osagean Series Kinderhookian Series	Limestone and sandstone Dolomite, limestone, and shale Limestone, dolomite, and siltstone
Devonian confining beds	0 to 350	Devonian (345 to 400 million years old)	Yellow Spring Group Lime Creek Shale	Shale, dolomite and siltstone Dolomite and shale
Devonian aquifer	0 to 400		Cedar Valley Limestone Wapsipinicon Limestone	Limestone and dolomite Dolomite, limestone, and shale
Silurian aquifer	0 to 450	Silurian (400 to 425 million years old)	Gower Dolomite * Hopkinton Dolomite Kankakee Limestone Edgewood Dolomite	Dolomite, with some chert and limestone
Ordovician confining beds	300 - 600	Ordovician (425 to 500 million years old)	Maquoketa Shale Galena Dolomite Decorah Formation Platteville Formation	Dolomite and shale Dolomite and chert Limestone and shale Limestone and shale
Cambrian-Ordovician aquifer	400 to 650		St. Peter Sandstone Prairie du Chien Formation Jordan Sandstone St. Lawrence Dolomite	Sandstone Dolomite, sandstone, and shale Sandstone Dolomite
Cambrian confining beds	90 - 290	Cambrian (500 to 600 million years old)	Franconia Sandstone	Shale, siltstone, and sandstone
Dresbach aquifer	157 to 1644		Dresbach Group Galesville Sandstone Eau Claire Sandstone Mt. Simon Sandstone	Sandstone Sandstone, shale, and dolomite Sandstone
Precambrian rocks		Precambrian (600 to more than 2 billion years old)	Crystalline rocks, undifferentiated	Sandstone, igneous and metamorphic rocks.

*Upper part includes the LaPorte City Chert in the northwest part of the report area.

The nomenclature and classification of rock units in this report are those of the Iowa Geological Survey and do not necessarily coincide with those accepted by the U.S. Geological Survey.

Source: [3]

3.4 Site Geology/Hydrogeology

Information regarding the site geology/hydrogeology at the Collis facility is primarily contained in two hydrogeologic assessment reports prepared by Terracon Consultants, Inc. for Collis in September 1983 [14] and July 1984 [18]. This two-phased study was specified in an Agreed Findings and Order on Consent dated January 24, 1983 [12] and was designed to delineate the facility's hydrogeologic setting and to investigate the effects of past sludge disposal in the unlined surface impoundments utilized from 1970 to 1979 (Section 2.3). Information from previous drilling programs and from the 15 soil borings completed to bedrock as part of the study were utilized to assess the facility's geologic and hydrogeologic setting. Six of the soil borings were completed as ground-water monitoring wells and the rest as piezometer points. Only one of these ground-water monitoring wells (MW-13) is currently being utilized by the facility.

Recently, nine additional soil borings have been completed by Warzyn Engineering Inc. for Collis in the immediate vicinity of the sludge impoundments [40]. Completion of these additional soil borings was specified in a Consent Agreement and Consent Order dated December 31, 1987 [37]. Three of these recent borings have been completed as ground-water monitoring wells (MW-20, MW-21, and MW-22) and are currently being utilized by the facility. The locations of all four ground-water monitoring wells currently being utilized are shown in Figure 2.

The surface topography at the Collis site does not reflect the top of the bedrock surface, which appears to be somewhat erratic [14]. A map depicting the bedrock topography is shown in Figure 3. Depths to the top of bedrock range from as deep as 118 feet to as shallow as six feet. A buried bedrock valley appears to be present trending northwest-southeast near the southwest corner of the property. A second bedrock valley appears to form near the north central portion of the facility property sloping downhill toward the east-northeast. The top of the bedrock encountered in each boring at the site is a soft, yellowish brown, thin-bedded, moderately to highly weathered limestone which is probably the Silurian age Anamosa Formation of the Gower Dolomite [14](Table 2).

The unconsolidated overburden at the Collis site reportedly consists primarily of alternating layers of clayey silt interbedded with varying thicknesses of fine to coarse sand or silty sand [14]. Across the northern half of the site where the sludge impoundments are located, fill material, consisting of silt with varying amounts of clay, organic matter, cinders, bricks, and gravel and ranging in color from dark brown to dark gray, occurs at ground surface and continues to depths ranging from five to 12 feet.

Shallow ground water has been encountered in borings completed at the Collis site at depths ranging from 2.5 to 14.3 feet below ground surface [14]. The direction of ground-water flow in the unconfined shallow aquifer is generally northwest across the site toward Manufacturer's Ditch. Figure 4 is a ground-water contour map interpreted from ground-water elevations obtained in May 1984. This shallow ground water is probably recharging Manufacturer's Ditch [14].

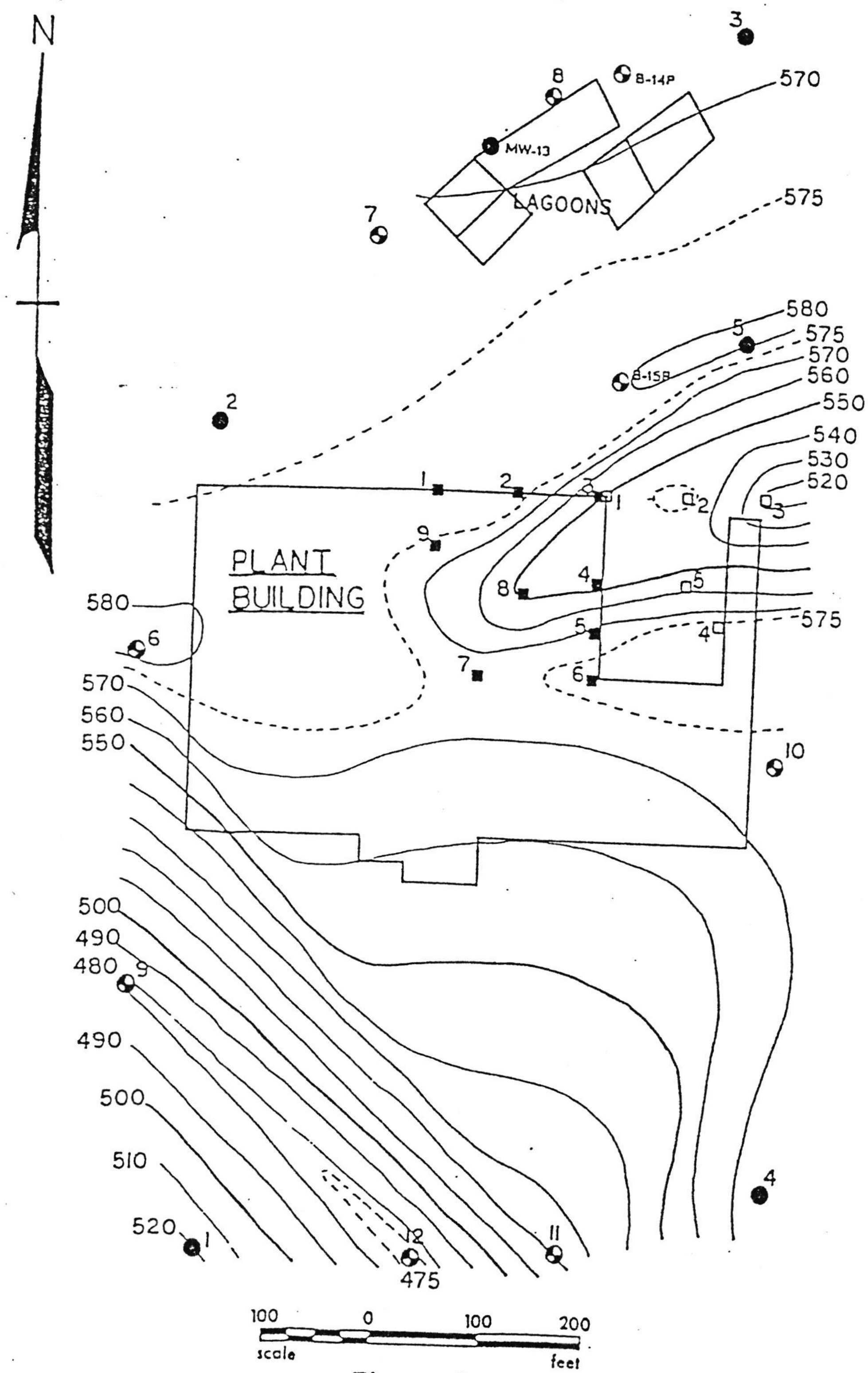


Figure 3.
Bedrock Topographic Map
Source: [18]

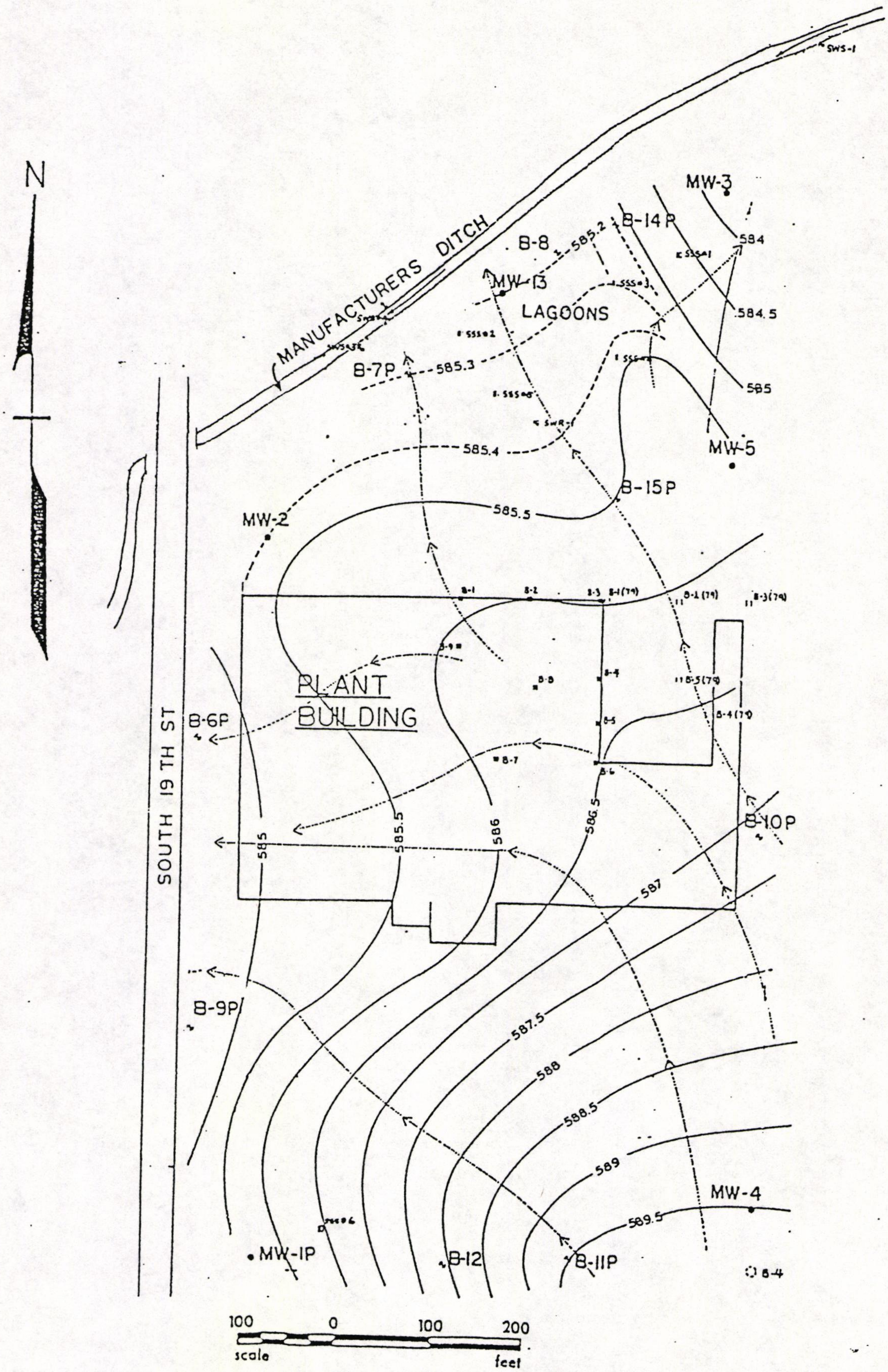


Figure 4.
Ground-Water Level Contour Map
(5/1/84)
Source: [18]

Horizontal flow gradients in the unconsolidated sediments range from as high as an average of one percent to as low as 0.1 percent [14]. Slug tests indicate that the average horizontal hydraulic conductivities for wells screened in the unconsolidated sediments range from approximately 3 to 9 x 10^{-7} cm/sec [14]. Shallow/deep staged monitoring points indicate upward vertical gradients ranging from one to six percent between bedrock wells and wells screened in the unconsolidated overburden [14]. Horizontal flow gradients in the bedrock range from 0.5 percent to 1.5 percent with horizontal hydraulic conductivities ranging from 3 x 10^{-4} to 4 x 10^{-5} cm/sec [14].

The facility currently monitors the shallow ground water with four monitoring wells (MW-13, MW-20, MW-21, and MW-22) all installed in the immediate vicinity of the sludge impoundments. All four wells are constructed of two-inch PVC casing and screen and range in total depth from seven to 20 feet. Boring logs with completion details for the four wells are shown in Appendix 2. Monitoring well MW-22 is the designated upgradient well while wells MW-13, MW-20, and MW-21 are all designated downgradient. This ground-water monitoring system is designed only to monitor shallow ground water potentially affected by the sludge impoundments [38].

Two ground-water production wells have been identified within one half mile of the Collis facility. These include the facility's own water supply well located on-site (Figure 2), and a city water supply well located about one-quarter mile north of the facility (Figure 1). Total depth of the Collis well is 1,633 feet and total depth of the city well is 2,202 feet. Both wells produce from Ordovician and Cambrian age carbonates and sandstones. Borehole logs for both wells are shown in Appendix 2.

4.0 SOLID WASTE MANAGEMENT UNITS

A total of 15 solid waste management units (SWMUs) or groups of units have been identified at the Collis facility. Nearly all of the SWMUs identified operate as part of the facility's wastewater treatment system, referred to in this report as the wastewater treatment plant (WWTP). In general, the WWTP includes SWMUs for the collection and storage of effluent prior to treatment, and units for the treatment, neutralization, and clarification of the wastewater prior to final discharge. A more complete and detailed description of the facility's wastewater treatment processes and the various units which comprise the WWTP follows under the discussion of the individual SWMUs or groups of SWMUs.

4.1 Floor Drain, Sump, and Overhead Pipe System

<u>Unit and Waste Characteristics</u> As discussed in Section 2.2, the Collis facility utilizes a series of floor drains, sumps, and overhead pipes to collect waste streams from the zinc plating lines, powder coating line, and kolene salt line (see Zinc Plating Area, Powder Coating Area, and Kolene Salt Line in Figure 2) and to transfer these wastes to treatment units in the WWTP. The floor drains in the zinc plating lines area consist of PVC pipe, approximately four inches in diameter, laid in concrete troughs in the concrete floor (Appendix 1, Photograph 1). According to facility personnel, questioned during the VSI, the PVC pipes were installed in 1986. Prior to this time, the open concrete troughs covered with steel grates were utilized as the floor drains. Within the powder coat area, the open concrete trough floor drains covered with metal grates are still used. The troughs are approximately 12

inches wide and four inches deep and appear to have been constructed when the floor was originally poured.

The waste streams dumped into the floor drains in the zinc plating area include spent caustic cleaning solutions, rinse waters, spent HCl acid pickle solutions, spent chromate solution, spent sodium metasilicate solution, and, occasionally, spent nitric acid pickle solution. Any sludges which accumulate in these dip baths are also flushed into the floor drains. Spent caustic cleaning solutions, rinse waters, and HCl acid solutions from the kolene salt line are also dumped into the zinc plating area floor drain system. The waste streams collected in the powder coat line floor drains include spent caustic cleaning solution, rinse waters, spent iron-phosphate solution, and spent chromate solution, all from the washer unit (see Section 2.2).

The waste streams dumped into the floor drain system are collected in sumps for transfer to the WWTP. The waste streams are pumped from the sumps to the WWTP through an overhead fiberglass and PVC pipe system. These pipes vary between two and four inches in diameter.

Four separate sumps are maintained in the zinc plating area for the collection of caustic cleaning solutions, rinse waters, acid pickle solutions, and sodium metasilicate solution. These sumps also collect caustic cleaner rinse waters, and HCl acid solutions from the kolene salt line. The different waste streams are diverted to separate storage or treatment units in the WWTP; therefore, the separate waste streams are not dumped into the floor drain system at the same time. Two additional sumps are maintained in the zinc plating area for the collection of spent chromate solution. Rinse waters from tanks following the chromate immersion tanks are also collected in the spent chromate solution sumps. One additional sump is maintained in the powder coating line area to collect all waste streams from the powder coat process.

The four cleaner/rinse/acid sumps in the zinc plating area and the one in the powder coating area are all approximately two feet wide, six feet long, and five feet deep (Appendix 1, Photograph 2). The two spent chromate sumps are circular in shape, roughly four feet in diameter, and five feet deep (Appendix 1, Photograph 3). The cleaner/rinse/acid sumps are concrete lined and the chromate sumps are steel lined.

According to facility personnel, questioned during the VSI, the floor drain system, chromate sumps, and overhead pipe system in the zinc plating area were constructed as an original part of the WWTP in 1970. However, as previously noted, the zinc plating area drain system was retrofitted with PVC pipe in 1986. The four cleaner/rinse/acid sumps in the zinc plating area were added in 1986. The floor drain system, single sump, and overhead pipe system in the powder coating area were installed in 1983, when the powder coating process units themselves were constructed.

<u>Evidence of Release</u> No evidence of release from the floor drain, sump, and overhead pipe system was observed during the VSI nor has a release been previously documented.

- Recommendations. No additional evaluation of the floor drain, sump, and overhead pipe system, as part of this RFA, is recommended at this time.

4.2 Chrome Treatment Tanks

Unit and Waste Characteristics Spent chromate solution from the spent chromate sumps is routed to one of three chrome treatment tanks located in the pollution control building (see Pollution Control Building in Figure 2). The tanks were constructed as part of the original WWTP in 1970. All three tanks are concrete-lined and constructed subgrade. According to facility personnel, questioned during the VSI, the largest tank is approximately ten feet by eleven feet by ten feet deep and has about an 8,000 gallon capacity. The other two tanks are both approximately six feet by six feet by ten feet deep and each has a capacity of about 2,500 gallons. All three tanks are covered with a concrete pad which has several material entry points (Appendix 1, Photograph 4).

The concentration of chromium in the facility's chromate solutions is currently maintained at approximately 200 mg/l. Prior to the facility's conversion to a non-cyanide based plating process, completed in December 1985, a concentration of about 75 g/l chromium was maintained. The currently used dilute chromate solution, however, is formulated with fluoride which now is also treated for in the chrome treatment tanks.

The spent chromate solution is treated with sulfur dioxide in the chrome treatment tanks to reduce hexavalent chrome to trivalent chrome. The spent chromate solution is treated for fluoride removal by the addition of calcium chloride and lime. Prior to conversion to the zinc-chloride plating process, the chrome treatment tanks were also used for cyanide treatment. The two-stage alkaline chlorination cyanide destruction process was segregated from the chrome treatment process but utilized one or two of the same chrome treatment tanks.

Evidence of Release During the VSI, it was not possible to inspect the integrity of the tanks due to the concrete pad cover and the active operation of the tanks at that time. No evidence of release has been previously documented; however, no leak detection system or ground-water monitoring capability exists adjacent to the tanks. It should be noted that the bases of the ten foot deep subgrade tanks are probably beneath the facility's shallow ground-water table.

- Recommendations. The facility needs to substantiate the integrity of the chrome treatment tanks and assure that waste materials are not migrating into the shallow ground-water system. This may include a thorough inspection and assessment of the overall condition of the units when empty and not actively operating. It may also include the collection and analysis of soil and ground-water samples adjacent to the tanks. No additional evaluation of the chrome treatment tanks, as part of this RFA, is recommended at this time.

4.3 Spent Acid Tank

Unit and Waste Characteristics Spent acidic solutions from the zinc plating, powder coating, and kolene salt lines are pumped to the spent acid tank for storage prior to batch neutralization. The spent acid tank, located just outside the pollution control building (Figure 2, #1), is a closed top, polypropylene tank about ten feet high and ten feet in diameter and with a capacity of approximately 5,400 gallons (Appendix 1, Photograph 5). The tank is constructed on an elevated concrete pad and is surrounded by a spill containment structure. The spill containment structure consists of a concrete pad with a three foot high concrete containment wall (Appendix 1, Photograph 6). Facility personnel, questioned during the VSI, indicated that spent acids are stored in the tank for one to two weeks before neutralization. The facility has utilized a spent acid tank since the WWTP was constructed in 1970; however, the current tank is a replacement, having been installed in 1987. The spill containment structure was added in 1980 or 1981 [7].

Evidence of Release Leakage from the tank was evident during the VSI in the form of minor staining and erosion of the tank's concrete pad (Appendix 1, Photograph 6). It was not clear whether the release was on-going or from a previous leak which had since been repaired. It is also possible that the leak was from the tank replaced in 1987. There was no evidence of a breach in the tank's containment system, however. There is no documentation of previous releases from the unit.

- Recommendations. The facility should correct or document previous repairs to the apparent leak, observed during the VSI, in the spent acid tank. No additional evaluation of the unit, as part of this RFA, is recommended at this time.

4.4 Spent Cleaner Tank

Unit and Waste Characteristics Spent caustic cleaning solutions from the zinc plating, powder coating, and kolene salt lines are pumped to the spent cleaner tank for storage prior to batch neutralization. The tank is located just outside the pollution control building (Figure 2, #2) adjacent to the spent acid tank (Section 4.3). The unit is an open top, fiberglass tank about ten feet high and ten feet in diameter with a capacity of about 5,000 gallons (Appendix 1, Photograph 5). The tank is constructed on the same elevated concrete pad as the spent acid tank and shares the same concrete spill containment structure. Facility personnel, questioned during the VSI, indicated that spent caustic cleaning solutions are stored in the tank one to two weeks before neutralization. The tank has been in use since 1970.

Evidence of Release

No evidence of leakage from the tank was observed during the VSI nor has there been any previous documentation of releases from the unit. As noted in Section 4.3, the concrete containment structure surrounding both the spent acid and spent cleaner tanks appears to be in good condition and capable of containing a complete rupture of at least one of the units.

- Recommendations. No additional evaluation of the spent cleaner tank, as part of this RFA, is recommended at this time.

4.5 Kolene Salt Tank

Unit and Waste Characteristics The kolene salt tank is used to dissolve spent kolene salt bricks from the kolene salt line prior to neutralization. The tank is located within the pollution control building (see Pollution Control Building in Figure 2) atop a concrete pad covering the neutralization tank (Section 4.6). The tank is an open top, square, metal bin measuring approximately three feet by three feet by four feet deep and with a capacity of about 200 gallons (Appendix 1, Photograph 7). The bin also contains a mixing device which accelerates the dissolution in hot water of the spent kolene salt bricks. According to facility personnel, questioned during the VSI, the tank has been in use since late 1985 or early 1986. Prior to this time, the spent kolene salt was transported for off-site disposal as a solid waste [15].

The spent kolene salt bricks consist primarily of caustic soda and some sodium nitrate [32] but can be expected to also contain the epoxy lacquer and epoxy powder coating removed from the stripped shelving items. MSDS sheets for the epoxy lacquer, a lacquer thinner, and the epoxy powder coating are shown in Appendix 3 (3-1, 3-2, and 3-3, respectively). Note that the MSDS sheets for the epoxy lacquer and thinner lists several hazardous constituents. Facility personnel, questioned during the VSI, indicated that the spent kolene salt material has not been previously analyzed for hazardous constituents.

Evidence of Release Any spills or leaks from the kolene salt tank can be expected to be contained within the neutralization tank (Section 4.6) which is where the dissolved spent kolene salt effluent is directed during normal operating procedures. No evidence of a release from the kolene salt tank was observed during the VSI nor has any previous release been documented.

- Recommendations. No additional evaluation of the kolene salt tank, as part of this RFA, is recommended at this time. However, it is recommended that the facility analyzed the final WWTP sludge and wastewater effluent for the hazardous constituents contained in the epoxy lacquer and thinner (see Section 4.9). Detection of these hazardous constituents would suggest that the facility should modify the current use of the kolene salt tank.

4.6 Neutralization Tank

Unit and Waste Characteristics The neutralization tank is used to collect and neutralize spent rinse waters directly from the zinc plating or powder coating lines, treated chromate solution from the chrome treatment tanks, spent acidic solutions from the spent acid tank, spent caustic cleaning solutions from the spent cleaner tank, and dissolved spent kolene salt solution from the kolene salt tank. The neutralization tank, located within the pollution control building (see Pollution Control Building in Figure 2), is a subgrade, rectangular, concrete basin measuring roughly 15 feet by 17 feet by ten feet deep with about an 18,000 gallon capacity. The tank is covered by a concrete pad which includes several material entry points. The pH of solutions contained in the tank are maintained at about 8.5 with the periodic addition of lime from a hopper positioned on the concrete pad cover. The tank is an original part of the facility's WWTP constructed in 1970.

Evidence of Release During the VSI, it was not possible to inspect the integrity of the tank due to the concrete pad cover and the active operation of the unit at that time. No evidence of a release has been previously documented; however, no leak detection system or ground-water monitoring capability exists adjacent to the tank. It should be noted that the base of the neutralization tank is probably beneath the facility's shallow ground-water table.

- Recommendations. The facility needs to substantiate the integrity of the neutralization tank and assure that waste materials are not migrating into the shallow ground-water system. This may include a thorough inspection and assessment of the overall condition of the unit when empty and not actively operating. It may also include the collection and analysis of soil and ground-water samples adjacent to the tank. No additional evaluation of the neutralization tank, as part of this RFA, is recommended at this time.

4.7 Settling Basin

Unit and Waste Characteristics The settling basin is located north of the main plant building adjacent to Manufacturer's Ditch (Figure 2, #3). The unit is an open top, subgrade, concrete tank measuring approximately 60 feet long by 30 feet wide (Appendix 1, Photograph 8). The tank has a tapered base, about 12 feet deep at one end grading to 27 feet deep at the opposite end. Total capacity is about 125,000 gallons. The unit is an original part of the facility's WWTP, constructed in 1970.

The settling basin receives neutralized effluent from the neutralization tank, cleaning water from backflushing of the filter house final effluent filter, and wastewater from the filter house sludge press (see Section 4.9). The settling basin is used to clarify the facility's wastewater through the gravity settling of metal hydroxides, primarily of zinc and chrome. Precipitation of the metals is enhanced by the addition of a flocculant to the waste stream (Appendix 3, MSDS sheet 3-4).

Evidence of Release During the VSI, the facility was maintaining only about three feet of freeboard in the settling basin which rendered inspection of the integrity of the unit impossible (Appendix 1, Photograph 9). No evidence of a release to ground water has been previously documented; however, no leak detection system or ground-water monitoring capability exists adjacent to the unit. Documentation indicates that overtopping has previously occurred releasing waste materials to surface soils and surface water bodies [5]. No evidence of recent overtopping was observed during the VSI, however.

- Recommendations. The facility needs to substantiate the integrity of the settling basin and assure that waste materials are not migrating into the shallow ground-water system. This may include a thorough inspection and assessment of the overall condition of the unit when empty and not actively operating. It may also include the collection and analysis of soil and ground-water samples adjacent to the tank. No additional evaluation of the unit, as part of this RFA, is recommended at this time.

4.8 Temporary Storage Tank

Unit and Waste Characteristics The temporary storage tank is located adjacent to the settling basin north of the main plant building (Figure 2, #4). Facility personnel, questioned during the VSI, indicated that the temporary storage tank is used to hold sludges from the settling basin during shutdown for maintenance of that unit every two to three years. Documentation also indicates that the tank is used occasionally as an auxiliary to the settling basin [30]. The tank has been in use since 1986.

The temporary storage tank is an above grade, open top, fiberglass tank approximately 18 feet tall and 15 feet in diameter and with a capacity of about 23,000 gallons (Appendix 1, Photograph 8). The unit is constructed on a plywood pad and does not include any type of spill containment structure.

Evidence of Release The temporary storage tank appeared to be in good condition and no evidence of releases from the unit were observed during the VSI. There is also no documentation of previous releases from the unit.

- Recommendations. The facility may need to consider the construction of a spill containment structure to ensure safe operation of the unit during its periodic use. No additional evaluation of the tank, as part of this RFA, is recommended at this time.

4.9 Filter House

Unit and Waste Characteristics The filter house is located just east of the settling basin along the northern boundary of the Collis property (Figure 2, #5). The filter house includes a 1,000 gallon steel thickening tank where sludge pumped from the bottom of the settling basin is held prior to being dewatered in a plate and frame pressure filter (Appendix 1, Photograph 10). The unit also contains a diatomaceous earth leaf filter for final clarification of wastewater effluent from the settling basin prior to discharge to Manufacturer's Ditch through the facility's NPDES-regulated outfall point (Appendix 1, Photograph 11). The filter house was put in service in 1979 [19].

Water pressed from the sludge is returned to the settling basin as well as spent filter material from the diatomaceous earth filter. The dewatered sludge is accumulated in a small bin (about one-half cubic yard capacity) from a conveyor belt beneath the filter press. (Appendix 1, Photograph 12). The small bin is periodically emptied into a larger, canvas covered hopper (about 15 cubic yards capacity) which is stored just outside the filter house (Appendix 1, Photograph 13). The hopper is periodically shipped off-site for disposal of the sludge, currently as a non-hazardous waste.

An analysis of the WWTP sludge, representative of what is transported for off-site disposal, is shown in Table 3. However, no documentation has been reviewed as part of this report indicating whether the final sludge or wastewater effluent has been analyzed for the hazardous organic constitutents contained in the epoxy lacquer and thinner which may be added to the waste stream from the kolene salt tank (see Section 4.5). It should also be noted that documentation indicates that the final sludge from the filter house was disposed, at least periodically, as a non-hazardous solid waste prior to the facility's conversion to the non-cyanide plating process [8]. During this time, the sludge should have been considered an F006 RCRA listed hazardous waste (40 CFR Part 261.31). Documentation indicates that landfills in Rockford, Illinois [5], Davis Junction, Illinois [8], Belvidere, Illinois [20], and the Clinton County East Landfill in Iowa [6] were all used for disposal of the sludge as a non-hazardous waste prior to the conversion to the non-cyanide based plating process.

Evidence of Release Documentation of the release of waste materials from the filter house operation includes several reports of leaking sludge bins and hoppers from the early 1980s [5, 9]. In addition, sludge was also noted accumulating beneath a transfer bin which was subject to runoff to Manufacturer's Ditch in November 1981 [10]. However, no evidence of current releases from the filter house operations were observed during the VSI.

Table 3.
WWTP Sludge Sample
Analytical Results, 9/14/86
Source: [32]

Date Sampled: 9/14/86 Date Received: 9/23/86

Sample Identity: Wastewater Sludge

Analysis

	As Received	
Total Solids	40.50	%
Paint Filter Liquids Test	0	ml/100 g
	Dry Weight Basis	
Arsenic (as As)	3.7	mg/kg
Barium (as Ba)	69	mg/kg
Cadmium (as Cd)	8.1	mg/kg
Calcium (as Ca)	190,000	mg/kg
Chromium (as Cr)	3,300	mg/kg
Copper (as Cu)	4,200	mg/kg
Iron (as Fe)	9,900	mg/kg
Lead (as Pb)	23	mg/kg
Magnesium (as Mg)	10,000	mg/kg
Mercury (as Hg)	<1.2	mg/kg
Nickel (as Ni)	82	mg/kg
Selenium (as Se)	<0.1	mg/kg
Silver (as Ag)	8.2	mg/kg
Zinc (as Zn)	75,000	mg/kg
Sulfide	<10	mg/kg
Reactive Sulfide	<10	mg/kg
Cyanide (as CN)	<1.3	mg/kg
Reactive Cyanide (as CN)	<1.3	mg/kg

<means less than

All analyses performed in accordance with EPA publication SW-846.

Table 3 continued.

EP Toxicity Analysis

Date Sampled: 9/14/86 Date Received: 9/23/86

Sample Identity: Wastewater Sludge

Analysis

	Concentration of Extract (mg/l)
Arsenic (as As)	0.002
Barium (as Ba)	<0.1
Cadmium (as Cd)	0.06
Chromium (as Cr)	0.05
Hexavalent Chromium (as Cr)	<0.05
Lead (as Pb)	<0.2
Mercury (as Hg)	0.0010
Selenium (as Se)	0.002
Silver (as Ag)	0.02
Final pH (of Extract)	5.6 S.U.

<means less than

EP Toxicity Test performed in accordance with 40 CFR Part 261.24. All analysis performed in accordance with EPA publication SW-846.

- Recommendations. The facility should provide an analysis of the final filter house sludge and wastewater effluent for hazardous organic constituents; especially those hazardous organic constituents contained in the epoxy lacquer and thinner which may enter the waste stream from the kolene salt tank (see Section 4.5). No additional evaluation of the filter house, as part of this RFA, is recommended at this time.

4.10 Sludge Impoundments

Unit and Waste Characteristics The sludge impoundments are located near the northeast corner of the Collis property (Figure 2, #6). The impoundments, constructed in 1970, were used between 1970 and 1979 for the disposal of sludges from the WWTP [19]. Originally, the impoundments were reported to have been approximately seven feet deep, having been excavated to depths of approximately three to four feet below ground surface and surrounded by berms which were roughly three to four feet above ground level [6]. The bases of the unlined impoundments were zero to two feet above the shallow ground-water table [6]. The number of impoundments varied, usually either five or six, as the facility would occasionally combine smaller impoundments or subdivide larger excavations.

The impoundments received sludges from the settling basin (Section 4.7) until 1979 when the sludge press (Section 4.9) was constructed and the facility began disposing of the material off-site. During the period 1970 to 1979, the facility was utilizing the cyanide based zinc plating process; therefore, the sludges would have been F006 RCRA listed hazardous wastes (40 CFR Part 261.31). Collis also operated a nickel-chrome plating line until 1972. Wastes from the nickel-chrome plating line would also have been treated in the WWTP. An analysis of the WWTP sludge, prior to the conversion to non-cyanide based plating process and thought to be representative of the material disposed of in the impoundments, is shown in Table 4. A range of concentrations analyzed from sludges actually contained in the impoundments is shown in Table 5. The impoundments were estimated to have contained approximately 1,090 cubic yards of sludge when first shutdown [19].

Remediation of the sludge impoundments originally began in 1980 [6] but was suspended in late 1981 due to the excessive costs involved [11]. Of the five impoundments existing at that time, one was closed and covered, two remained open, and two were left in varying stages of partial closure [11]. The facility had been transporting the removed sludges for off-site disposal [6]; however, waste piles of sludge mixed with soil reportedly remained in the impoundment area following cessation of this initial remediation effort [11].

No documentation was reviewed as part of this report confirming that all contamination was adequately removed from the one impoundment closed and covered. Review of successive aerial photographs, dated September 16, 1979 and September 18, 1984, indicate that the impoundment closed and covered was to the southeast of the other remaining impoundments (aerial photographs are reproduced as Figures 5 and 6). Facility personnel, questioned during the VSI, speculated that the covered impoundment was only a low area which collected precipitation runoff and was gravelled in to allow less restricted truck access to the plant's loading dock. Review of the 1979 aerial photograph (Figure 5), however, suggests that communication in the form of a ditch or trench existed between the covered impoundment and the other impoundments which were definitely used for sludge disposal.

Table 4.
WWTP Sludge Sample
Analytical Results, 11/21/85
Source: [32]

Date Sampled: 11/19/85

Date Received: 11/21/85

Sample Identity: Sludge

Analysis

	As Received	
Total Solids	35.88	%
Free Liquids	<1	ml/100 g

	Dry Weight Basis	
Arsenic (as As)	6.4	mg/kg
Barium (as Ba)	250	mg/kg
Cadmium (as Cd)	4.2	mg/kg
Calcium (as Ca)	184,000	mg/kg
Chromium (as Cr)	34,000	mg/kg
Hexavalent Chromium (as Cr)	2,600	mg/kg
Copper (as Cu)	500	mg/kg
Iron (as Fe)	16,000	mg/kg
Lead (as Pb)	98	mg/kg
Magnesium (as Mg)	9,200	mg/kg
Mercury (as Hg)	<0.5	mg/kg
Nickel (as Ni)	280	mg/kg
Selenium (as Se)	22	mg/kg
Silver (as Ag)	8.4	mg/kg
Zinc (as Zn)	84,000	mg/kg
Cyanide (as CN)	1,040	mg/kg
Reactive Cyanide (as CN)	960	mg/kg
Sulfide	<33	mg/kg
Reactive Sulfide	<33	mg/kg

< means less than

All analyses performed in accordance with EPA publication SW-846.

Table 4 continued.

EP Toxicity Analysis

Date Sampled: 11/19/85

Date Received: 11/21/85

Sample Identity: Sludge

Analysis

	Concentration of Extract (mg/l)
Arsenic (as As)	0.047
Barium (as Ba)	<0.1
Cadmium (as Cd)	0.05
Chromium (as Cr)	19
Hexavalent Chromium (as Cr)	0.53
Copper (as Cu)	0.50
Lead (as Pb)	0.3
Mercury (as Hg)	<0.0005
Nickel (as Ni)	1.8
Selenium (as Se)	<0.010
Silver (as Ag)	0.02
Zinc (as Zn)	1,050
Final pH (of Extract)	5.6 S.U.

<means less than

EP Toxicity Test performed in accordance with 40 CFR Part 261.24. All analysis performed in accordance with EPA publication SW-846.

Table 5.
Sludge Impoundments Area
Sludge Sample Analytical Result Ranges
Source: [33]

Content	Impoundment Sludge
pH	9.6 - 10
% solids	18.0 - 28.5
total cyanide	424 - 1090
reactive CN	<0.13
total sulfide	4250 - 15300
reactive sulfid	<1.0
Arsenic	5.86 - 15.8
Barium	29.3 - 96.0
Cadmium	1.30 - 4.05
Total Chromium	2730 - 4850
Hexavalent Chromium	<18
Lead	1.83 - 53.4
Mercury	<0.070 - 0.201
Nickel	402 - 1270
Selenium	<15.4 - <32.4
Silver	0.20 - 0.78
Zinc	24400 - 62600

Notes: 1) All values in mg/kg except pH and % solids

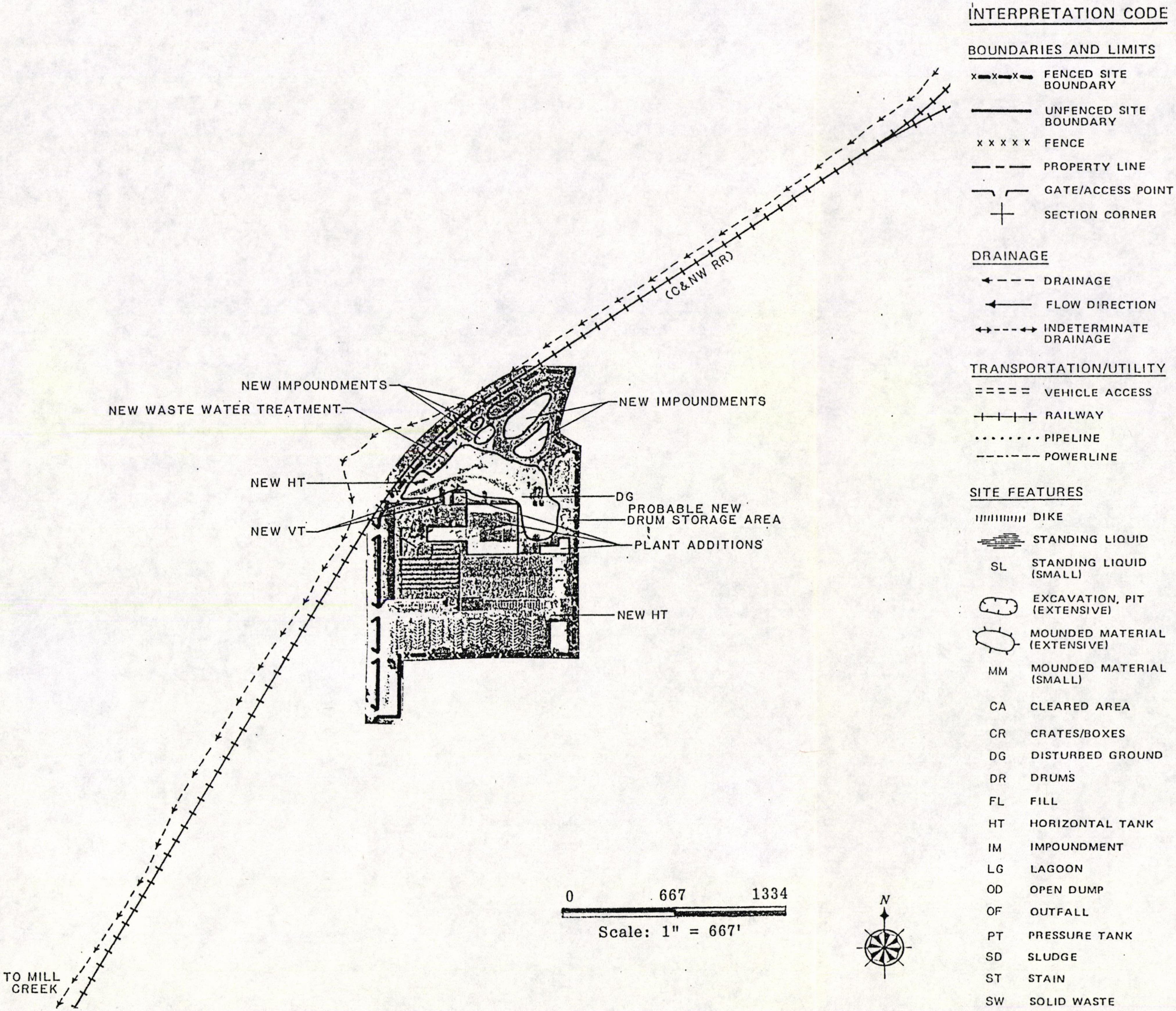
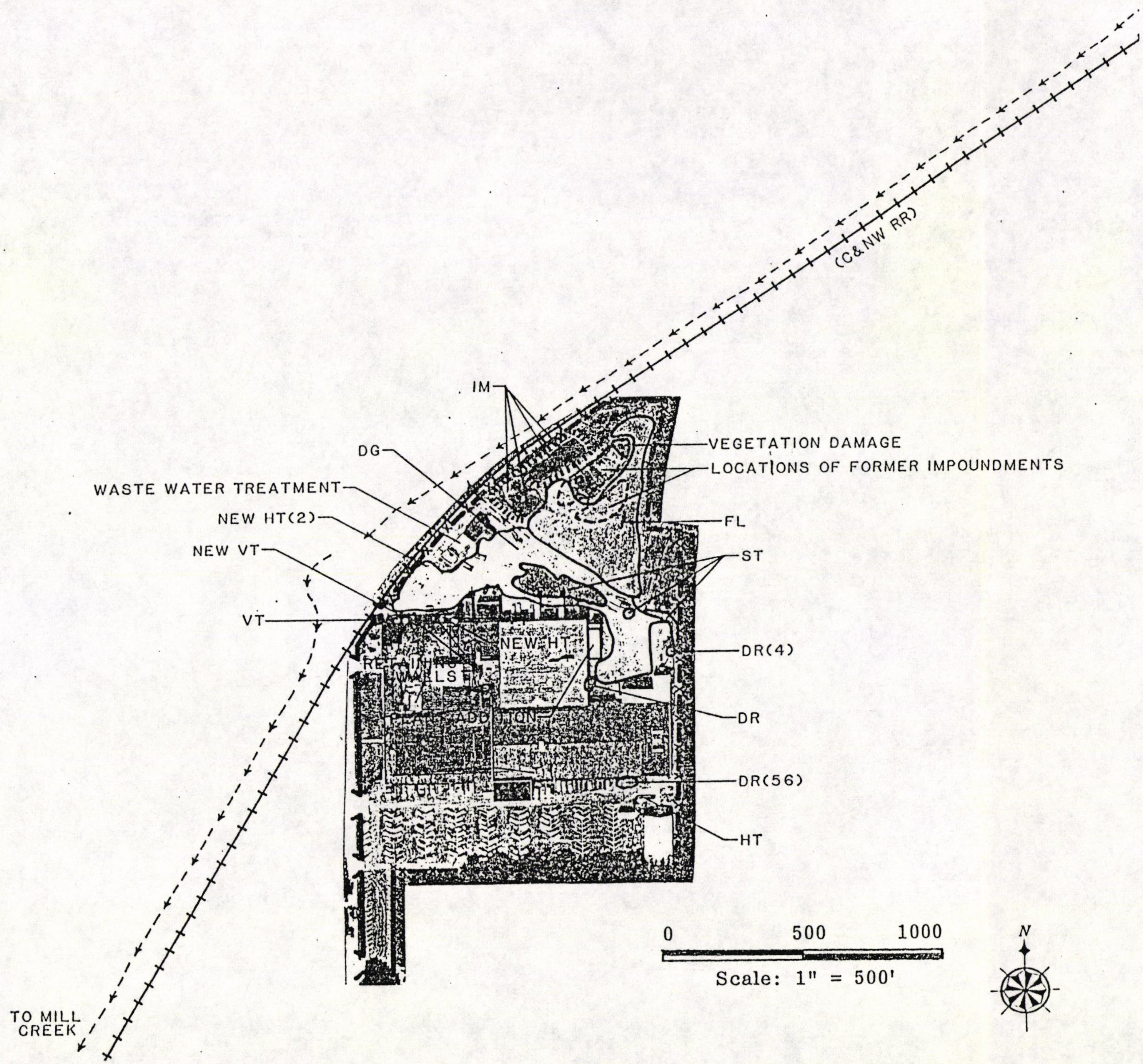


Figure 5. Chamberlain Manufacturing Corporation, September 16, 1979.
Approximate scale 1:4,000.
Source: Supplied by EPA Region VII.



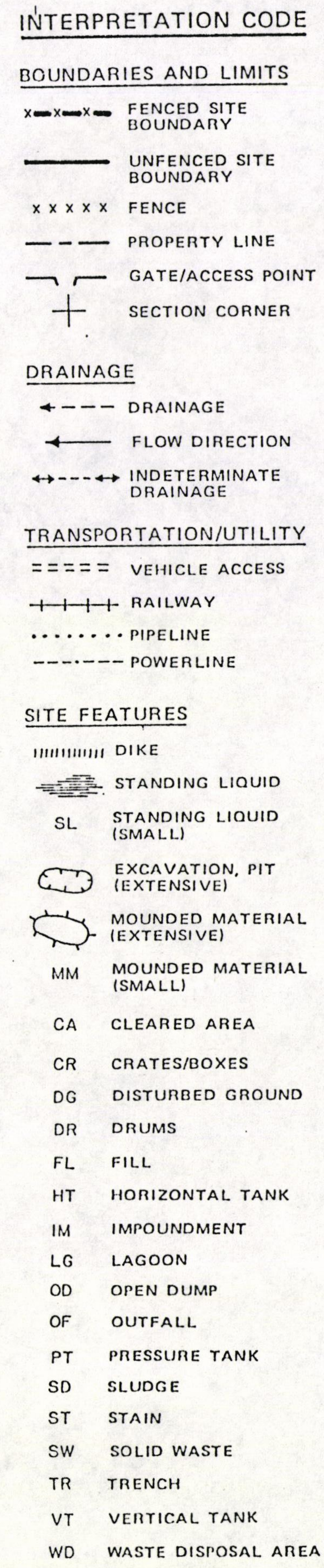


Figure 6. Chamberlain Manufacturing Corporation, September 18, 1984.
Approximate scale 1:3,000.
Source: Supplied by EPA Region VII.

By early 1983, the facility signed a Consent Order agreeing to a series of studies designed to delineate the environmental impact of waste management practices at the site, including sludge disposal in the sludge impoundments ([12] see also Section 3.4). Collis then submitted a closure plan to EPA detailing activities to complete remediation of the impoundments in August 1984 [19]. Remediation efforts continued in late 1986 and early 1987 as sludges and contaminated soils remaining in the impoundments were excavated, stabilized with lime, fly ash, and kiln dust, and transported off-site for disposal [31]. Approximately 10,703 tons of waste were transported for disposal in Peoria, Illinois as a hazardous waste [31]. The facility also removed 358,200 gallons of water from the impoundments at that time [31]. Approximately 270,250 gallons were pretreated (see Section 4.13) and discharged to the Clinton Water Pollution Control Plant [31]. The other 87,950 gallons were transported to Chicago, Illinois for disposal as a hazardous waste [31].

By late 1987, Collis had signed another Consent Order agreeing to additional sampling and monitoring of the impoundment area, and to complete backfilling and regrading of the excavations [37]. During the VSI, it was observed that the sludge impoundments have yet to be backfilled and regraded. Three impoundments remain from the 1987 excavation activities, each containing several feet of standing water. The area surrounding the impoundments is overgrown with weeds and shows no signs of recent activity.

Evidence of Release Direct releases of waste materials from the sludge impoundments have been previously documented on several occasions. A November 1978 wastewater treatment facility inspection reported that the impoundments were bank full and that sludges had washed out of the corner of one impoundment and had drained off the property toward the railroad tracks and Mill Creek [4]. The 1980 PA/SI report noted that Collis had pumped supernatant and some sludge from one of the impoundments to a low area adjacent to the railroad tracks [6]. A sketch map provided with the PA/SI report shows this low area adjacent to railroad tracks to have been outside the facility's property boundary [6]. The PA/SI report also noted that cyanide gas had possibly escaped from the impoundments during dredging activities, affecting personnel working on the initial remediation effort [6]. A March 1981 compliance inspection reported that sludge from one of the impoundments had washed into Manufacturer's Ditch [7]. A May 1981 compliance monitoring and inspection report noted that Collis had pumped water from one of the impoundments to a low area along side the railroad tracks, north and east of the plant, which drained off-site to Manufacturer's Ditch [8].

The studies designed to assess the environmental impact of sludge disposal in the impoundments initially concluded that the impoundments had not significantly affected the surrounding soils or shallow ground water system [18]. A summary of ground-water monitoring results from these studies is shown in Table 6. It should be noted that several chlorinated organic compounds including methylene chloride, trichloroethylene, dichlorodiflouromethane, and dichloroethylene were detected in the ground-water samples. The facility, however, has claimed to have never used these organic compounds [26]. Analytical results from ground-water samples collected from the recently installed ground-water monitoring wells (see Section 3.4) have also been reviewed for this report [40]. However, these samples have not been analyzed for cyanide, chromium, zinc, nickel, or the chlorinated organic compounds previously detected.

Type Location Sample Date	Groundwater MW-2 5-31-83	 6-20-83	 5-11-84	Groundwater MW-3 5-31-83	 6-20-83	 5-11-84	Groundwater MW-5 5-31-83	 6-20-83	 5-11-84	Groundwate MW-13 5-11-84
Analysis	mg/l			mg/l			mg/l			mg/l
Arsenic	0.019	0.038	0.006	0.015	0.020	0.004	0.008	0.027	0.005	0.003
Cadmium	0.0031	0.0046	--	0.001	0.0022	--	0.001	0.0006	--	0.003
Total Chromium	0.005	0.047	0.038	0.006	0.053	0.32	0.005	0.025	0.19	0.031
Hex. Chromium	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Copper	0.043	0.010	0.02	0.019	0.011	0.01	0.012	0.062	0.02	0.01
Mercury	0.0006	0.0006	--	0.0004	<0.0003	--	0.0002	0.003	--	<0.0003
Nickel	0.13	0.16	0.46	0.040	0.007	0.08	0.053	0.09	0.06	0.05
Zinc	0.86	0.13	0.09	0.06	0.040	0.08	0.10	0.03	0.10	0.10
Lead	0.015	0.025	0.33	0.017	0.020	0.36	0.030	0.022	0.27	0.30
Total Cyanide	0.04	<0.01	--	0.03	0.03	--	<0.01	0.08	<0.01	<0.01
Amenable Cyanide	0.04	<0.01	--	0.01	<0.01	--	<0.01	<0.01	<0.01	<0.01
TOC	8	54	130	61	29	100	150	170	230	140
Temperature (°C)	13	13	13	13	13	12	13	15	13	13
pH	7.14	6.99	6.24	7.81	7.80	5.94	7.35	6.98	5.87	6.04
Specific Cond.	3800			1000			1500			

Table 6.
Ground-Water Monitoring Results
Source: [18]

Type	Water	Water	
Location	MW-2	MW-5	
Sample Date	5-11-84	5-11-84	
Analysis			Units
1,3 Dichloro-1-propylene, cis	<0.1	<0.1	ug/l
1,3 Dichloro-1-propylene, trans	<0.1	<0.1	ug/l
Methylene chloride	3.6	3.4	ug/l
1,1,2,2 Tetrachloroethane	<0.1	<0.1	ug/l
Tetrachloroethylene	0.2	<0.1	ug/l
1,1,1 Trichloroethane	0.1	<0.1	ug/l
1,1,2 Trichloroethane	<0.1	<0.1	ug/l
Trichloroethylene	150	0.1	ug/l
Vinyl chloride	<1.0	<1.0	ug/l
Bromodichloromethane	1.9	<0.1	ug/l
Bromoform	<0.1	<0.1	ug/l
Bromomethane	<1.0	<1.0	ug/l
Carbon tetrachloride	<0.1	<0.1	ug/l
Chloroethane	<1.0	<1.0	ug/l
2 Chloroethylvinyl eher	<0.1	<0.1	ug/l
Chloroform	<0.1	<0.1	ug/l
Chloromethane	<1.0	<1.0	ug/l
Dibromomethane	<0.1	<0.1	ug/l
Dichlorodifluoromethane	110	<1.0	ug/l
1,1 Dichloroethne	0.1	<0.1	ug/l
1,2 Dichloroethane	<0.1	<0.1	ug/l
1,1 Dichloroethylene	2.1	<0.1	ug/l
1,2 Dichloroethylene, trans	1300	0.9	ug/l
1,2 Dichloropropane	0.4	<0.1	ug/l

Table 6 continued.

Type Location Sample Date	Background Groundwater MW-1 5-31-83	 6-20-83	Background Groundwater MW-4 6-20-83
Analysis	mg/l		mg/l
Arsenic	0.013	0.010	0.018
Cadmium	0.007	0.0016	0.0006
Total Chromium	0.003	0.038	0.040
Hex. Chromium	<0.05	<0.05	<0.05
Copper	0.008	0.012	0.035
Mercury	0.0006	0.0007	<0.0003
Nickel	0.023	0.11	0.043
Zinc	0.05	0.41	0.08
Lead	0.011	0.033	0.016
Total Cyanide	0.03	<0.01	<0.01
Amenable Cyanide	0.02	<0.01	<0.01
TOC	25	19	72
Temperature (°C)	13	13	13
pH	8.40	8.63	7.48
Specific Cond. (uohms/cm)	800		

Table 6 continued.

The facility sampled and analyzed soils from the impoundment area for cyanide, chromium, and zinc following excavation of the units in 1986 and 1987 [33]. These analytical results are reproduced in Table 7. Table 7 shows that elevated levels of these materials still exist in the impoundment area soils. Soil samples from more recently completed soil borings, reproduced in Table 8, also indicate elevated levels of nickel, chromium, zinc, and cyanide remain in the impoundment area soils. The facility, however, claims that the contaminants are virtually immobile and not a threat to human health or the environment [33].

Additional analytical results from soil samples obtained during the late 1986/early 1987 remediation efforts (Table 9) show elevated PCB and oil and grease levels in the impoundment soils. The 1980 PA/SI report noted that an oily substance was observed in the bottom of one of the impoundments which had probably leached from metal shavings stored 50 yards south of the impoundments [6]. Past waste oil spills have been documented at the facility [15] as has oil residue in a shallow boring (B-15P, see Figure 2) located just south of the impoundment area ([18] see also Section 4.15). Oily staining of soils in several of the impoundments as well as a slight oil sheen on the standing water were noted during the VSI (Appendix 1, Photograph 14); however, Collis claims to have never disposed waste oils anywhere on the facility property [26]. No documentation has been reviewed as part of this report addressing the occurrences of PCBs.

- Recommendations. Several aspects regarding previous remediation efforts and waste management practices in the sludge impoundments area appear to require additional investigation or review before closure of the units is certified. This includes clarification of the use and the effectiveness of remediation efforts for the one impoundment closed and covered in late 1981. More recent soil boring and sampling efforts by the facility have not included this area.

  In addition, the facility should address the significance of the oily material noted in the impoundment area, the occurrence of PCBs in surrounding soils, and the detection of chlorinated organics in the shallow ground water adjacent to the units. Identification of the source (see also Section 4.15) and possible association of these substances should be investigated. Finally, the facility should analyze ground-water samples from the most recently installed ground-water monitoring wells for analytes more indicative of ground-water impacts from the impoundments. These analytes should include, at a minimum, zinc, chromium, cyanide, nickel, PCBs, and the chlorinated organic compounds previously detected.

  No additional evaluation of the sludge impoundments area, as part of this RFA, is recommended at this time.

4.11 Container Storage Areas

Unit and Waste Characteristics Several container storage areas are currently maintained by the facility, primarily for raw material storage. Some of these areas currently are not waste management areas and may be more appropriately labeled areas of concern. Previously, however, the facility has utilized container storage areas to store hazardous wastes and currently some of the areas are used to manage wastes including spent oils and scrap metal prior to recycling.

Table 7.
Sludge Impoundments Area
Soil Sample Analytical Results
Source: [33]

SAMPLE LOCATION	DEPTH (FEET)	SOIL TYPE	TOTAL CYANIDE	CHROMIUM	ZINC
W1	2-4	sandy, gravel	243	103	1250
W1	4-6	sandy, gravel	237	53.4	1510
W1B	6-8	sandy clay	21.9	88.2	1210
S1	6-8	silty clay	5.18	24.3	135
S1B	0-2	organic clay	70.0	337	816
S1B	4-6	organic clay	23.5	259	753
S1B	8-10	silty clay	38.5	13.4	113
N2	0-2	silty clay fill	43.5	48.0	1140
N2	2-4	silty clay fill	72.0	23.4	1210
N2	4-6	organic clay	96.1	44.5	1270
N2	6-8	organic clay	35.8	23.2	624
N2	8-10	peaty clay	13.0	22.2	43.8
W2A	0-2	silty clay fill	114	251	798
W2A	4-6	organic clay	65.2	21.5	556
W2B	2-4	silty clay	19.4	18.1	915
W2B	6-8	clay, peat	9.75	24.4	355
N3	4-6	organic clay	63.0	18.2	547
N3	6-8	organic clay	25.0	13.1	292
N3	8-10	organic clay	56.8	20.3	242
N3	10-12	silty clay	2.90	18.3	52.1
W3	0-2	silty clay fill	12.5	74.1	403
W3	2-4	silt, clay	155	3290	4830
W3	4-6	silt	7.45	13.7	55.4
W3	6-8	oily silty clay	27.2	112	1120
E3A	0-2	organic slity clay	5.0	190	657
E3A	2-4	silty clay fill	98.0	338	1170
E3B	0-2	silty clay fill	63.0	110	857
E3B	8-10	organic silty clay	9.00	119	1130
S4A	0-2	silty clay fill	173	14730	21020
S4A	2-4	oily silty clay	57.8	638	2370
S4A	4-6	organic clay	27.4	183	4820
S4B	0-2	silty clay fill	53.3	2040	3800
S4B	2-4	silty clay fill	42.1	135	5150
S4B	10-12	silty clay	0.35	16.4	61.2
S4B	10-12	silty clay	21.9	29.7	84.8
S5	2-4	silty clay	68.1	2370	3380
S5B	0-2	silty clay fill	36.8	1000	3980
S5B	2-4	organic clay	452	1680	6450
S5B	4-6	silty clay	89.1	47.1	126
S5B	6-8	silty clay	81.4	72.6	472
E5A	0-2	sand, silty clay	14.4	372	927
E5A	2-4	organic silty clay	50.8	357	489

NOTES: 1) All values are in Mg/Kg as received.
2) Samples were collected 12/16/86 - 12/16/86; 1-23-87.

Table 7 continued.

SAMPLE LOCATION	DEPTH (FEET)	SOIL TYPE	TOTAL CYANIDE	CHROMIUM	ZINC
E5A	4-6	fine-medium sand	17.7	22.2	42.1
E5B	0-2	silty clay	36.0	136	560
E5C	0-2	organic silty clay	49.0	594	1490
E5C	8-10	silty clay	2.73	<15.0	37.3
W2C	4-6	organic clay	86.9	10.3	119
W2C	8-10	silt	112	7.63	62.6
W2C	0-2	silty clay fill	74.3	9.45	670
W2C	2-4	organic clay	27.8	21.0	1690
W2C	4-6	organic clay	52.5	10.7	63.1
W2C	6-8	silt	162	11.0	23.6
W1C	0-2	silty clay fill	201	662	1020
W1C	2-4	organic clay	34.9	46.2	931
W1C	4-6	organic clay	29.8	21.6	71.2
W1C	6-8	silt	22.8	18.2	81.6
S1C	0-2	silty clay fill	211	6990	8050
S1C	2-4	organic clay	282	4010	7080
S1C	4-6	silty clay	55.7	18.4	158
S1C	6-8	silt	16.1	8.85	36.3
S5C	0-2	silty clay fill	133	4140	11000
S5C	2-4	organic clay	202	75.7	515
S5C	4-6	silty clay	19.2	21.6	57.7
W2C	4-6	organic clay	86.9	10.3	119
W2C	8-10	silt	112	7.63	62.6
W2C	0-2	silty clay fill	74.3	9.45	670
W2C	2-4	organic clay	27.8	21.0	1690
W2CD	4-6	organic clay	52.5	10.7	63.1
W2C	6-8	silt	162	11.0	23.6
W1C	0-2	silty clay fill	201	662	1020
W1C	2-4	organic clay	34.9	46.2	931
W1C	4-6	organic clay	29.8	21.6	71.2
W1C	6-8	silt	22.8	18.2	81.6
S1C	0-2	silty clay fill	211	6990	8050
S1C	2-4	organic clay	282	4010	7080
S1C	4-6	silty clay	55.7	18.4	158
S1C	6-8	silt	16.1	8.85	36.3
S5C	0-2	silty clay fill	133	4140	11000
S5C	2-4	organic clay	202	75.7	515
S5C	4-6	silty clay	19.2	21.6	57.7

NOTES: 1) All values are in Mg/Kg as received.
2) Samples were collected 12/16/86 - 12/18/86; 1/23/87.

Table 7 continued.

SAMPLE LOCATION	DEPTH (FEET)	SOIL TYPE	TOTAL CYANIDE	CHROMIUM	ZINC
W2C	4-6	organic clay	86.9	10.3	119
W2C	8-10	silt	112	<7.63	62.6
W2C	0-2	silty clay fill	74.3	9.45	670
W2C	2-4	organic clay	27.8	21.0	1690
W2CD	4-6	organic clay	52.5	10.7	63.1
W2C	6-8	silt	162	11.0	23.6
W1C	0-2	silty clay fill	201	662	1020
W1C	2-4	organic clay	34.9	46.2	9.31
W1C	4-6	organic clay	29.8	21.6	71.2
W1C	6-8	silt	22.8	18.2	81.6
S1C	0-2	silty clay fill	211	6990	8050
S1C	2-4	organic clay	282	4010	7080
S1C	4-6	silty clay	55.7	18.4	158
S1C	6-8	silt	16.1	<8.85	36.3
S5C	0-2	silty clay fill	133	4140	11000
S5C	2-4	organic clay	202	75.7	515
S5C	4-6	silty clay	19.2	21.6	57.7
SE5	0-2	silty clay fill	248	2220	3410
SE5	0-6	organic clay	95.5	138	78.1
E5D	2-4	silty clay	414*	5400	5000
E5D	6-8	silty clay	245*	19.6	29.0
N5	0-2	organic clay	72.6*	30.2	111
N5	2-4	silty clay	415*	16.7	42.5
N5D	2-4	organic clay	80.4*	16.7	38.1
N5	4-6	hole cave-in	507*	27.0	204
E3C	0-2	silty clay fill	68.0*	17.9	553
E3C	2-4	organic clay/peat	394*	55.6	2020
E3C	6-8	organic clay	419*	30.4	519
N3B	0-2	silty clay fill	72.3*	47.3	2.96
N3B	2-4	organic clay	429*	14.0	94.6
N3B	4-6	organic clay	21.6*	11.9	63.2
L#4-Bottom B		organic clay	4.19*	21.2	30.1
L#4-Bottom A		silty clay	2.23*	16.7	30.1

* -- MATRIX INTERFERENCES RESULTED IN LOW RECOVERIES OF SPIKED SAMPLES.

NOTES: 1) All values are in Mg/Kg as received.
2) Samples were colleted 12/16/86 - 12/18/86; 1/23/87.

Table 8.
Recent Sludge Impoundments Area
Soil Sample Analytical Results
Source: [40]

LAB NO.	COMPOSITE OF:	DATE	NICKEL	CHROMIUM	TOTAL SOLIDS (%)
21121	B7-S1, B8-S1, W21-S1	02/04/88	50.6	86.4	79.8
21122	B7-S2(A), B8-S2, W21-S2	02/04/88	18.8	20.8	71.5
21123	B7-S3, B8-S3, W21-S3	02/04/88	23.2	24.2	65.6
21124	B4-S1, B5-S1, B6-S1	02/03/88	143	516	79.5
21125	B4-S2, B5-S2, B6-S2	02/03/88	414	1270	77.6
21126	B4-S3, B5-S3, B6-S3	02/03/88	40.5	55.5	70.6
21127	B1-S3, B2-S3, B3-S2	02/03/88	111	846	79.8
21128	B1-S4, B2-S4, B3-S3	02/03/88	112	632	56.0
21129	B1-S5, B2-S5, B3-S4	02/03/88	5.66	<5.00	70.9

RESULTS ARE REPORTED IN MG/KG (WET WEIGHT BASIS) UNLESS OTHERWISE STATED.

METHOD REFERENCE: SW846, "TEST METHODS FOR EVALUATING SOLID WASTE", SEPTEMBER, 1986.

METHODS 3050 & 7520: NICKEL
METHODS 3050 & 7190: CHROMIUM

EPA-600, "METHODS FOR CHEMICAL ANALYSIS OF WATER AND WASTES", MARCH, 1983.

METHOD 160.3: TOTAL SOLIDS

Table 8 continued.

SAMPLE DESCRIPTION	EXTRACT #1	EXTRACT #2	EXTRACT #3
PH ADJUSTMENT (S.U.)	NONE	7-8	<2
CYANIDE	4.94	-	-
ZINC	-	2.17	4.84
CHROMIUM	-	2.00	2.04

RESULTS ARE REPORTED IN MG/L ON A 24-HOUR EP WATER LEACHING TEST UNLESS OTHERWISE STATED.

Table 9.
Sludge Impoundments Area
Soil Sampling During Remediation Efforts
Analytical Results
Source: [31]

LAB #	SAMPLE DESCRIPTION	DEPTH (FEET)	TOTAL CYANIDE	SULFIDE	CHROMIUM	PH (S.U.)
13008	TP1 - 1	2	213	<0.10	1110	7.7
13009	TP1 - 2	3	256	<0.10	719	7.6
13010	TP2 - 1	2	229	<0.10	1220	7.4
13011	TP2 - 2	3.5	52	14.9	1530	6.8
13012	TP2 - 3	6	133	0.11	34.4	7.7
13013	TP3 - 1	4	978	<0.10	12600	9.5
13014	TP3 - 2	8.5	966	<0.10	8400	9.2

RESULTS ARE REPORTED IN MG/KG AS RECEIVED UNLESS OTHERWISE STATED.

Table 9 continued.

	13076 TP-4	13077 TP-5
	=====	=====
OIL & GREASE (MG/KG AS RECEIVED)	13500	15400
TOTAL CYANIDE (MG/KG AS RECEIVED)	33	69
ARSENIC	<0.010	<0.010
BARIUM	1.15	1.15
CADMIUM	<0.02	<0.02
CHROMIUM	<0.20	<0.20
LEAD	<0.50	<0.50
MERCURY	<0.0005	<0.0005
SELENIUM	<0.010	<0.010
SILVER	<0.05	<0.05
PCB 1260 (MG/KG AS RECEIVED)	36.0	1.60
PCB 1254 (MG/KG AS RECEIVED)	<4.0	<0.10
PCB 1248 (MG/KG AS RECEIVED)	<4.0	<0.10
PCB 1242 (MG/KG AS RECEIVED)	<4.0	<0.10
PCB 1232 (MG/KG AS RECEIVED)	<4.0	<0.10
PCB 1016 (MG/KG AS RECEIVED)	<4.0	<0.10
PCB 1221 (MG/KG AS RECEIVED)	<4.0	<0.10

RESULTS ARE REPORTED IN MG/L ON AN EP TOXICITY EXTRACTION UNLESS OTHERWISE STATED.

Table 9 continued.

13011:
TP2-2

PCB'S

AROCLOR 1016	LESS THAN 2.0	PPM
AROCLOR 1221	LESS THAN 2.0	PPM
AROCLOR 1232	LESS THAN 2.0	PPM
AROCLOR 1242	LESS THAN 2.0	PPM
AROCLOR 1248	LESS THAN 2.0	PPM
AROCLOR 1254	LESS THAN 2.0	PPM
AROCLOR 1260	29.3	PPM

METHOD REFERENCE

PESTICIDE ANALYTICAL MANUAL, VOLUME I.

METHOD REFERENCES

METHOD LISTED ABOVE WITH RESULTS

Table 9 continued.

LAB #	SAMPLE DESCRIPTION		TOTAL CHROMIUM	TOTAL CYANIDE
13246	POND #4	EAST BERM 6"	1310	240
13247	POND #4	EAST 12"	1130	239
13248	POND #4	NORTH 6"	3420	510
13249	POND #4	NORTH 12"	5470	867
13250	POND #4	SOUTH 6"	253	254
13251	POND #4	SOUTH BERM 12"	89.2	57
13252	POND #4	EAST 12" DUPLICATE	1060	187

RESULTS ARE REPORTED IN MG/KG AS RECEIVED.

The facility currently maintains a container storage area inside the main plant building, referred to as the chemical storage area, and two additional container storage areas, one located inside and one outside the main plant building, at the receiving dock (Figure 2, #7, 8, and 9). The chemical storage area is used to store bulk raw materials including caustic cleaners, chromic acid mixtures, kolene salts, boric acid, sodium metasilicate, iron phosphate, diatomaceous earth, and metallic zinc (Appendix 1, Photograph 15). No waste materials are kept in the chemical storage area. Most materials are stored on pallets on top of the concrete floor. There is no spill containment structure for the area; however, a majority of the materials kept in the chemical storage area are granular solids.

The storage area inside the main plant building at the receiving dock is used to store bulk lime for the neutralization tank, drums of epoxy lacquer and solvent thinner, potash, zinc-chloride mixture, and some lube oils and cleaning solutions (Appendix 11, Photograph 16). Most of these materials are also stored on pallets on the concrete floor. A concrete pad outside the receiving dock back door is used to store empty drums, steel racks, and a dumpster which holds scrap metal parts which are periodically sold for recycling. Facility personnel, questioned during the VSI, also indicated that waste oil drums are periodically stored on the outside storage pad prior to recycling. As with the chemical storage area, there are no spill containment structures for the receiving dock storage areas.

Previously, the facility has maintained container storage areas for storing hazardous wastes. It is not clear, however, where or for what period of time some of the containerized hazardous wastes were stored or where the wastes were eventually disposed. Documentation indicates that both the receiving dock storage areas have been used to store hazardous wastes including drums of zinc-cyanide bath plating sludge (RCRA listed hazardous waste F008) and drums of "unknown" wastes [20]. Collis also apparently had maintained an area for storing zinc-cyanide plating bath sludges in the yard northeast of the main plant building [7, 11]. No concrete pad existed in his area as drums were stored only on pallets [7]. Facility personnel, questioned during the VSI, however, indicated that most containerized hazardous wastes were previously stored inside the main plant building in an area which now contains wire straightening machines. This area is no longer used to store any containers.

<u>Evidence of Release</u> A December 1981 RCRA compliance inspection report indicated that drums of hazardous waste in the yard northeast of the receiving dock area (see Northeast Yard in Figure 2) were in marginal condition and that eventual leakage and spillage was anticipated [11]. An actual release from a container storage area was then documented in October 1984 when a leaking zinc sludge drum was noted in a IDWAWM report of investigation [28]. The location of the container storage area, however, was not indicated.

During the VSI, it was observed that the facility's current container storage areas appeared well maintained and orderly. The only releases noted were minor spills of granular substances (bulk raw materials), especially in the chemical storage area.

- Recommendations. It is recommended that the facility construct spill containment structures in their container storage areas, especially in any areas used to store liquid substances. No additional evaluation of the container storage areas, as part of this RFA, is recommended at this time.

4.12 Spent Chromic Acid Tank

Unit and Waste Characteristics The spent chromic acid tank, located adjacent to the north side of the main plant building (Figure 2, #10), was previously used to store spent chromate solution from the zinc plating lines. The tank was installed in 1975 but has not been used since the conversion to the dilute chromate dip process completed in December 1985 (Section 2.2). The spent chromate solution from the zinc plating lines now goes directly to the chrome treatment tanks (Section 4.2).

The fiberglass, closed top spent chromic acid tank is constructed on a concrete pad and measures approximately 12 feet tall and ten feet in diameter (Appendix 1, Photograph 17). The tank has a capacity of about 5,500 gallons. A concrete spill containment structure surrounds the tank. The tank, however, has been emptied and rinsed and is currently unused.

Evidence of Release No evidence of release from the spent chromic acid tank has been documented.

- Recommendations. No additional evaluation of the currently unused spent chromic acid tank, as part of this RFA, is recommended at this time.

4.13 Pretreatment Tanks

Unit and Waste Characteristics The pretreatment tanks were used to treat standing water from the sludge impoundments during the late 1986, early 1987 remediation activities (see Section 4.10). The pretreatment tanks were located near the northwest corner of the property adjacent to the settling basin (Figure 2, #11). The unit consisted of three, interconnected, 27 feet diameter, above-ground containment pools with a total capacity of 45,000 gallons [31]. The pools were constructed of double 20 mil vinyl liners within a steel frame [31].

The pretreatment process conducted in the pools involved the oxidation of free cyanide by the addition of calcium hypochlorite, pH adjustment by the addition of sulfuric acid, and physical settling of the waste stream [31]. The tanks operated only during the late 1986, early 1987 sludge impoundment remediation activity. A total of 270,250 gallons of standing water from the impoundments treated in the tanks were discharged to the City of Clinton wastewater treatment plant [31]. During the VSI, it was observed that the pretreatment tanks have been dismantled and exist only as rolls of vinyl and steel frame pieces stored on the ground where the tanks were once used.

Evidence of Release No evidence of release from the pretreatment tanks was observed during the VSI. In addition, no documentation of releases from the unit has been reviewed.

- Recommendations. No additional evaluation of the pretreatment tanks, as part of this RFA, is recommended at this time.

4.14 Drying Oven

Unit and Waste Characteristics The drying oven was used to remove excess moisture from settled zinc-cyanide plating bath sludge for an unspecified period of time [23]. The use of the oven for that purpose has been discontinued and the oven is now used only in production processes [29]. The oven was reportedly recently decontaminated by steam cleaning [36].

Evidence of Release No documentation has been reviewed indicating any release of hazardous wastes from the drying oven. During the VSI, it was noted that the facility currently uses two ovens in the production process, one used to dry epoxy lacquer on the zinc plated shelving items, and one to melt epoxy powder and dry epoxy lacquer on shelving items from the powder coating line. It is assumed that one or both of these ovens were those previously used to dry the zinc-cyanide plating bath sludge.

- Recommendations. No additional evaluation of the drying oven, as part of this RFA, is recommended at this time.

4.15 Northeast Yard

Unit and Waste Characteristics The northeast yard in that area located between the main plant building and the sludge impoundments (See Northeast Yard in Figure 2). During the VSI, it was observed that the area is currently primarily a gravel pad or driveway for vehicles entering and exiting the facility's receiving area. Materials currently stored in the area consist primarily of stacks of wooden pallets. Previously, however, the area was used for hazardous waste container storage (see Section 4.11) and at one time contained a waste pile of metal shavings [6]. Documentation has not been reviewed indicating how long the northeast yard was used for hazardous waste.container or metal shavings waste pile storage, or how or when the waste pile was removed.

Evidence of Release Documentation indicates that waste oil spills have occurred in the northeast yard [15] and that oil may have leached from the metal shavings waste pile [6]. Reportedly, oil leached from the shavings migrated through soils to the sludge impoundments ([6], see also Section 4.10). An oily residue was noted in fill material in the northeast yard in borehole B-15P (borehole log shown in Appendix 2), completed as part of the facility's hydrogeologic assessment studies [18]. Also, low concentrations of chlorinated organic compounds have been detected in monitoring well MW-5 (Table 6) which was originally completed to provide upgradient ground-water quality information for the sludge impoundments [14].

The facility, however, claims to have never disposed waste oil on-site or to have used the organic compounds detected in well MW-5 [26]. Collis also claims, as company practice, to have cleaned up all spills of any type as soon as they occurred [29]. However, the occurrence of oily residue in borehole B-15P, oil staining in the sludge impoundments which possibly migrated from the metal shavings waste pile in the northeast yard, and the detection of chlorinated organics in well MW-5 suggest that somehow significant amounts of oily wastes have been incorporated into soils in the area.

- Recommendations. It is recommended that the facility investigate the possible contamination in the northeast yard. The extent of any oily contamination should be delineated as should the composition of the substances detected. This is especially important in that PCBs have been detected in soils in the sludge impoundments area (see Section 4.10). No additional evaluation of the northeast yard, as part of this RFA, is recommended at this time.

5.0 AREAS OF CONCERN

Four areas or units have been identified at the Collis facility which are used to manage or have previously been used to manage potentially hazardous materials but which do not meet the regulatory definition of a solid waste management unit. Most of these areas are not suspected of having released hazardous materials to the environment but may pose as potential future problems if not maintained. Two other areas have also been identified where a release of potentially hazardous substances is suspected but which again cannot be considered waste management areas. The following is a discussion of these individual areas of concern.

5.1 Nitric Acid Storage Tank

The nitric acid storage tank, located just west of the main plant building (Figure 2, #12), is used to store fresh nitric acid for use in the zinc plating process (see Section 2.2). This stainless steel tank measures approximately 14 feet by eight feet in diameter and has a capacity of about 5,000 gallons (Appendix 1, Photograph 18). The tank is constructed on an elevated concrete pad and is surrounded by a concrete containment wall.

The tank was observed to be in good condition during the VSI and no documentation of previous releases from the unit has been reviewed. No additional evaluation of the tank, as part of this RFA, is recommended at this time.

5.2 HCl Acid Storage Tank

The HCl acid storage tank is used to store fresh HCl acid for use in the zinc plating process (see Section 2.2). The tank is located adjacent to the nitric acid storage tank (Figure 2, #13) and shares the same concrete pad and containment system (Appendix 1, Photograph 18). The concrete pad under the HCl acid storage tank, however, is rubber-lined. The tank is constructed of polypropylene and measures approximately 12 feet high and 12 feet in diameter and has a capacity of about 6,200 gallons.

A spill of HCl acid was documented in a June 1984 wastewater treatment facility inspection [16]. The spill breached a leaky wall in the containment system and collected in puddles in the yard north of the main plant building. The pH of the puddles was recorded as low as 0.7 although they were later neutralized with lime. However, facility maps reviewed from this time suggest that the HCl acid storage tank used to be located adjacent to the currently unused spent chromic acid tank (Section 4.11). As noted under the discussion of the nitric acid storage tank (Section 5.1), the containment structure shared by the HCl acid and nitric acid storage tank was observed to be in good condition during the VSI with no evidence of recent releases. No additional evaluation of the HCL acid storage tank, as part of this RFA, is recommended at this time.

5.3 Zinc-Chloride Storage Tank

The zinc-chloride storage tank is located just inside the north wall of the main plant building (Figure 2, #14). This fiberglass tank is used to periodically hold the zinc-chloride plating solution when the zinc plating lines are shut down for maintenance. The tank measures approximately 18 feet tall and 15 feet in diameter and has a capacity of about 23,000 gallons. The tank is constructed on a concrete pad and is surrounded by a concrete containment structure.

During the VSI, the zinc-chloride tank was observed to be in good condition with no evidence of recent releases. No documentation of prior releases has been reviewed. No additional evaluation of the tank, as part of this RFA, is recommended at this time.

5.4 Sulfur Dioxide Storage Area

The sulfur dioxide (SO_2) storage area is located in the pollution control building (see Pollution Control Building in Figure 2) in a room adjacent to the chrome treatment and neutralization tanks. The SO_2 is used in the chrome reduction process in the chrome treatment tanks (Section 4.2). The SO_2 is stored in compressed gas cylinders measuring roughly eight feet long by two feet in diameter with a capacity of about 2,000 pounds of compressed gas. Several tanks are maintained in the area at any given time which are periodically replaced with refilled tanks.

The SO_2 storage area was observed to be in good condition during the VSI. No documentation of previous releases of the gas has been reviewed. No additional evaluation of the SO_2 storage area, as part of this RFA, is recommended at this time.

5.5 Epoxy Lacquer Tanks

The epoxy lacquer tanks are used as immersion baths in the epoxy coating portion of the plating process. The facility maintains two separate tanks in the main plant building (Figure 2, #15); one is used for the zinc plating line and one for the powder coating line. The tapered troughs measure roughly eight feet high, four feet wide, and 20 feet across the top (Appendix 1, Photograph 19). The steel tanks are kept in rooms separated from the main plating areas..

During the VSI, elevated HNU photoionizer readings were observed in the vicinity of the epoxy lacquer tanks. Readings averaging three to five parts per million (ppm) above background were recorded in working areas near the tanks. The HNU went off scale (0-20 ppm scale) when the doors to the tank rooms were opened. MSDS sheets for the epoxy lacquer and solvent thinner kept in the tanks (Appendix 3, sheets 3-1 and 3-2, respectively) show that both materials are formulated with several hazardous organic compounds. Several work stations, continually manned by facility personnel, are within the areas of constantly elevated HNU readings.

It is recommended that the facility provide better ventilation in those work areas near the epoxy lacquer tanks. Respiratory protection may also have to be provided for workers entering the rooms where the tanks are maintained. No additional evaluation of the epoxy lacquer tanks, as part of this RFA, is recommended at this time.

5.6 Manufacturer's Ditch

Manufacturer's Ditch, located outside the Collis property north boundary (Figure 2), has historically received wastewater effluent from the facility since probably at least 1964, and possibly since 1915 (see Section 2.3). Documentation indicates that since 1970, WWTP sludges have periodically entered the ditch [12] through overtopping or deliberate discharges from the settling basin [5] or sludge impoundments [4,6,7,8]. In early 1981, Collis attempted to remediate a portion of the ditch by removing bottom sludges with a vacuum truck [9]. However, additional WWTP sludges were reported to have been discharged to Manufacturer's Ditch following this removal activity [7]. No documentation of any other remediation efforts for the ditch was reviewed for this report.

The May 1983 site specific cyanide study of Mill Creek concluded that elevated levels of total nitrogen, phosphorus, cyanide, chromium, nickel, and zinc detected in sediment samples from Manufacturer's Ditch were probably from sludge deposition by Collis [13]. Sediment samples, analyzed during the facility's hydrogeologic assessment study, have also detected levels of chromium, nickel, zinc, and cyanide indicative of sludge contamination in the ditch [14]. These analytical results are reproduced in Table 10.

It is recommended that the facility further evaluate the previous disposal of waste materials in the ditch and characterize the environmental impact of the contamination apparently still present. Future remediation measures may be necessary based upon this additional assessment.

6.0 MIGRATION PATHWAYS AND POTENTIAL RECEPTORS

Migration pathways for releases from the facility's several subgrade SWMUs include seepage into surrounding soils and the shallow ground-water system. Discharge of the shallow ground water would then introduce waste materials to surface water migration pathways, primarily Manufacturer's Ditch. Overtopping or rupture above-grade from the facility's SWMUs would introduce waste materials to surface soils and, through runoff, directly to surface water migration pathways, again primarily Manufacturer's Ditch.

The greatest potential for exposure to waste materials, released from SWMUs at the Collis facility, exists for those organisms coming in contact with the nearby surface waters. Mill Creek, which drains Manufacturer's Ditch, is considered capable of supporting a warm water fishery [13]. Previously, wastewater effluent disposed by Collis in Manufacturer's Ditch has been suspected of fish kills [6] and cattle kills along Mill Creek [1] and elevated heavy metal contents in the Mississippi River downstream of Mill Creek [1]. These problems potentially attributable to Collis took place prior to the facility's conversion to a non-cyanide based plating process completed in December 1985. Evidence of continued contamination, however, still exists in sediments contained in Manufacturer's Ditch (see Section 5.6).

Type Location Sample Date	Soil SWS-1 (Sediment) 5-31-83	 6-20-83	Soil SWS-2 (Sediment) 5-31-83	 6-20-83
Analysis	mg/kg		mg/kg	
Arsenic	33	32	17	19
Cadmium	1.9	0.9	1.8	1
Total Chromium	550	150	1400	1800
Hex. Chromium	73	4	675	46
Copper	54	32	43	43
Mercury	0.73	1.0	0.34	<0.092
Nickel	550	130	230	230
Zinc	2300	2300	3000	2900
Lead	120	84	43	36
Total Cyanide	62	150	170	140
Amenable Cyanide	5.0	61	<1.0	<1.0
TOC	13000	15000	51000	5300

Table 10.
Manufacturer's Ditch Sediment Sample
Analytical Results
Source: [14]

7.0 SUMMARY

The Collis facility, located in Clinton, Iowa, has been involved in assembling and electroplating refrigerator shelving items since at least 1964. Recently, the facility switched from a cyanide-based to a chloride-based plating process which effectively ended the plant's generation of hazardous wastes. Consequently, most concerns regarding the facility's management of hazardous wastes involve historical waste management practices; specifically, the past use and current remediation of the sludge impoundments area and previous uses or problems in the northeast yard. Several current waste management practices, however, may also be of concern especially the use of subgrade tanks, the bases of which are below the local ground-water table, for the treatment of the facility's industrial wastewater. Table 11 includes a summary of all SWMUs and areas of concern at the Collis facility and the recommendations for further action for each.

TABLE 11
SUMMARY

Solid Waste Management Unit	Dates of Use	Recommendations
Floor drain, sump, and overhead pipe system	Zinc plating area - floor drains, chromate sumps, overhead pipes - 1970 to present (PVC pipes added to floor drains in 1986); cleaner/ rinse/acid sumps - 1986 to present. Powder coating area - all units - 1983 to present.	No further action.
Chrome treatment tanks	1970 to present.	Inspect overall condition; substantiate no migration of waste materials to shallow ground-water system.
Spent acid tank	1970 to present (new tank installed in 1987).	Repair or document previous repair of apparent leak.
Spent cleaner tank	1970 to present.	No further action.
Kolene salt tank	Late 1985/early 1986 to present.	Further action dependent upon analysis of final WWTP sludge and wastewater effluent for hazardous organic constituents.
Neutralization tank	1970 to present.	Inspect overall condition; substantiate no migration of waste materials to shallow ground-water system.
Settling basin	1970 to present	Inspect overall condition; substantiate no migration of waste materials to shallow ground-water system.
Temporary storage tank	1986 to present.	Construct a spill containment structure.
Filter house	1979 to present.	No further action.

TABLE 11
SUMMARY

	Dates of Use	Recommendations
Sludge impoundments	1970 to 1979.	Clarify use and remediation of impoundment covered in 1981; address occurrences of oily material and PCBs in soils and chlorinated organics in ground-water; monitor ground-water for analytes indicative of ground-water impacts from impoundments.
Container storage areas	Period of use as hazardous waste management areas is unknown; some minor use currently as solid waste management areas.	Construct spill containment structures in current container storage areas.
Spent chromic acid tank	1975 to 1985.	No further action.
Pretreatment tanks	Late 1986 to early 1987.	No further action.
Drying oven	Period of use as SWMU is unknown.	No further action.
Northeast yard	Unknown as a waste management area	Delineate extent and composition of potential oily contamination.
<u>Areas of Concern</u>		
Nitric acid storage tank	Unknown to present.	No further action.
HCl acid storage tank	Unknown to present.	No further action.
Zinc-chloride storage tank	Unknown to present.	No further action.
Sulfur dioxide storage area	1970 to present.	No further action.
Epoxy lacquer tanks	Zinc plating area - 1964 (?) to present; powder coating area - 1983 to present.	Provide better ventilation in nearby working areas.
Manufacturer's Ditch	Unknown to present	Investigate extent and effects of sediment contamination.

8.0 REFERENCES

[1] July 29, 1969; Letter regarding Collis Company discharge, Clinton, Iowa; From: R. L. Morris, The University of Iowa, State Hygienic Laboratory; To: R. J. Schliekelman, Environmental Engineering Service.

[2] December 14, 1970; Permit No. 70-307-8 for Waste Treatment Facilities for the Collis Company; Issued by the State of Iowa.

[3] 1978; Report; Water Resources of East-Central Iowa; Prepared by: U.S. Geological Survey in Cooperation with the Iowa Geological Survey.

[4] November 20, 1978; Report; Wastewater Treatment Facility Inspection, Collis Company; Iowa Department of Environmental Quality.

[5] June 12, 1980; Report; Wastewater Treatment Facility Inspection, Collis Company; Iowa Department of Environmental Quality.

[6] November 19, 1980; Report; Preliminary Assessment and the Site Inspection; Collis Corporation; Prepared by Ecology and Environment, Inc.

[7] March 30, 1981; Report; Wastewater Treatment Facility Compliance Inspections (2), Chamberlain Manufacturing Corporation; Iowa Department of Environmental Quality.

[8] May 18, 1981; Report; Compliance Monitoring and Inspection; Prepared by Environmental Research Group, Inc.; For U.S. Environmental Protection Agency Region VII, Surveillance and Analysis Division.

[9] June 30, 1981; Report; Wastewater Treatment Facility Inspection, Chamberlain Manufacturing Corporation; Iowa Department of Environmental Quality.

[10] November 2, 1981; Letter regarding waste management activities Chamberlain Manufacturing, Collis division, Clinton, Iowa; From: Louise D. Jacobs, Environmental Protection Agency, Region VIII, Enforcement Division; To: Robert A. Bell, Vice President, Collis Division, Chamberlain Manufacturing Corporation.

[11] December 23, 1981; Report; RCRA Compliance Inspection, Chamberlain Manufacturing Corporation; Iowa Department of Environmental Quality.

[12] January 24, 1983; Agreed Findings and Order on Consent between Chamberlain Manufacturing Corporation and U.S. Environmental Protection Agency.

[13] May 1, 1983; Report; Site-Specific Criteria Modification Study; Prepared by: Water Resources Development Branch, Program Development Division.

[14] September 28, 1983; Report; Hydrogeological Assessment for Collis Division Facility and U.S. EPA Region VII; Prepared by: Terracon Consultants, Inc.; For: Chamberlain Manufacturing Corporation.

[15] October 25, 1983; Report; RCRA Hazardous Waste Inspection, Chamberlain Manufacturing Corporation; Iowa Department of Water, Air and Waste Management.

[16] June 6, 1984; Report; Waste water Treatment Facility Inspection, Chamberlain Manufacturing Corporation; Iowa Department of Water, Air and Waste Management.

[17] June 26, 1984; Memo regarding permit for Collis Company NPDES Permit; From: Tim O'Connor; To: Pete Hamlin.

[18] July 12, 1984; Report; Hydrogeological Assessment for Collis, Inc.; Prepared by: Terracon Consultants, Inc.; For: Collis Inc.

[19] August 1984; Report; Closure Plan for the Metal Finishing Waste Surface Impoundments; Prepared by: Eugene A. Hicock & Associates; For: Collis Inc.

[20] September 6, 1984; Report; RCRA Hazardous Waste Inspection, Collis Inc.; Iowa Department of Water, Air and Waste Management.

[21] September 27, 1984; Iowa NPDES Permit for Collis Inc.; issued by the Iowa Department of Water, Air and Waste Management.

[22] November 1984; Report; Post-Closure Plan for the Metal Finishing Waste Surface Impoundments; Prepared by: Eugene A. Hicock & Associates; For: Collis Inc.

[23] December 26, 1984; Description of Waste; From: Collis Inc.

[24] March 5, 1985; Letter regarding how compliance with the September 1, 1985, limitations will be achieved; From: Robert A. Bell, Collis Inc.; To: Robert E. Campbell, Iowa Department of Water, Air and Waste Management.

[25] November 7, 1985; Letter concerning request for information; From: Robert A. Bell, Collis, Inc,; To: David A. Wagoner, U.S. Environmental Protection Agency, Region VII.

[26] February 25, 1986; Letter regarding the Closure, Post-closure and Groundwater Monitoring Plans for Collis, Inc; From: Rod Vlieger, Eugene Hicock & Associates, Inc.; To: Michael J. Sanderson, U.S. EPA, Waste Management Division.

[27] March 3, 1986; Letter in response to letter dated February 26, 1986; From: Dan Deters, Collis Inc.; To: Edward A. Moreno, Environmental Specialist III.

[28] April 29, 1986; letter with attachments regarding meeting held on April 1st; From: Robert A. Bell, Collis Inc.; To: Tom Styczen, Chamberlain Manufacturing Corporation.

[29] May 23, 1986; letter regarding Collis Inc. closure issues; From: Michael F. Dolan, Seyfarth, Shaw, Fairweather and Geraldson; To: Luetta Flournoy, Iowa Section, RCRA Branch, United States Environmental Protection Agency, Region VII

[30] October 9, 1986; report; RCRA Compliance Inspection at Collis Inc.; Prepared by: A.T. Kearney, Inc.; For: U.S. Environmental Protection Agency, Region VII.

[31] March 24, 1987; letter regarding request for information, Collis Inc.; From: Richard H. Irving, Duchossois Industries Inc.; To: Luetta Flourney, United States Environmental Protection Agency, Region VII.

[32] June 1, 1987; Report; RCRA Compliance Inspection at Collis Inc.; U.S. EPA, Region VII, Waste Management Division.

[33] July 1987; Report; Evaluation of Sludge Residuals, Collis Inc. Site, Clinton, Iowa; Prepared by: Warzyn Engineering Inc.; For: Collis Inc.

[34] August 14, 1987; Letter regarding fluoride limitations; From: Dan Deters, Collis Inc.; To: Lavoy Hagge, Wastewater Permits Section, Department of Natural Resources.

[35] October 2, 1987; Application for NPDES permit for cooling water and boiler blowdown water discharge for Collis Inc.

[36] December 18, 1987; Response to letter of November 4, 1987 regarding the July 1987 report "Evaluation of Sludge Residuals Collis Inc. Site, Clinton, Iowa."; From: Robert A. Bell, Collis Inc.; To: Michael J. Sanderson, U.S. EPA, Waste Management Division.

[37] December 31, 1987; Consent Agreement and Consent Order between Chamberlain Manufacturing Corporation and U.S. Environmental Protection Agency, Region VII

[38] January 27, 1988; Sampling and Analysis Plan, Groundwater Monitoring Plan for Site Closure for Metal Finishing Impoundment; Prepared by: Warzyn Engineering Inc.; For: Collis Inc.

[39] January 28, 1988; Report;RCRA Compliance Inspection at Collis, Inc; U.S. EPA, Waste Management Division, Region VII.

[40] July 27, 1988; Status report regarding surface impoundment closure; Prepared by: Warzyn Engineering Inc.; For: Collis Inc.

APPENDIX 1

PHOTOGRAPH # 1

OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Zinc plating area PVC pipe floor drain system

Location: Collis Inc., Clinton, Iowa

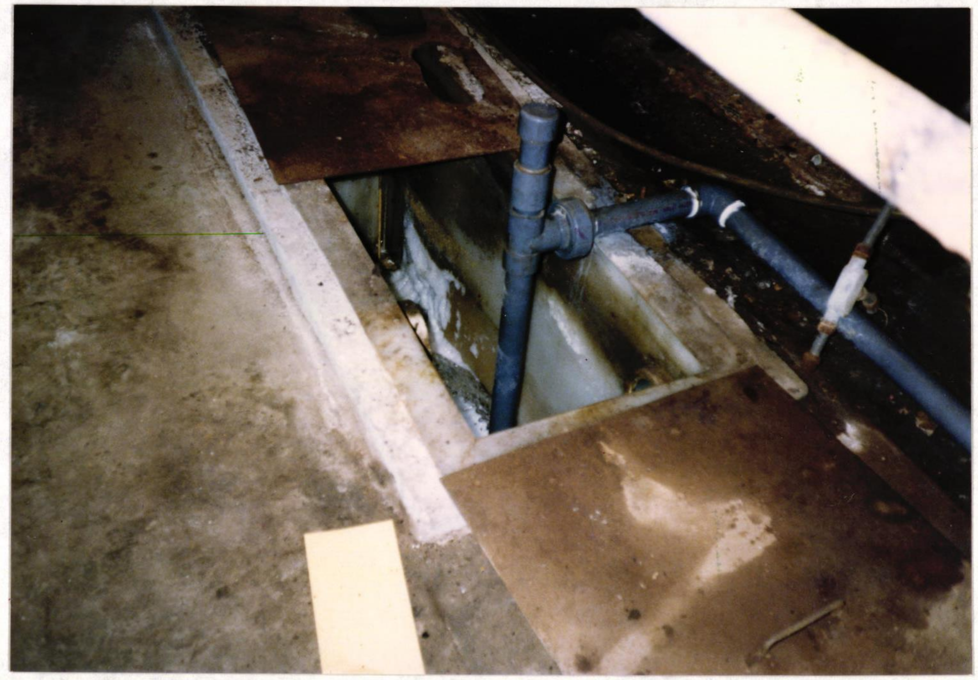
Date: 8-23-88 **Time:** 1325

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen



PHOTOGRAPH # 2

OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Zinc plating area cleaner/rinse/ acid sump

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1323

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

photo863

PHOTOGRAPH # 3
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Zinc plating area chromate sump

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1323

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

PHOTOGRAPH # 4
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Chrome treatment tank; below concrete pad in corner

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1345

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

photo863

PHOTOGRAPH # 5
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Spent acid tank (left) and spent cleaner tank (right)

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1351

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

PHOTOGRAPH # 6
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Containment structure and apparent leak, spent acid tank

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1350

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

photo863

PHOTOGRAPH # 7
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Spent kolene salt tank (blue bin) and neutralization tank (under concrete pad)

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1347

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

PHOTOGRAPH # 8
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Settling basin (left), temporary storage tank (right), and filter house (background)

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1410

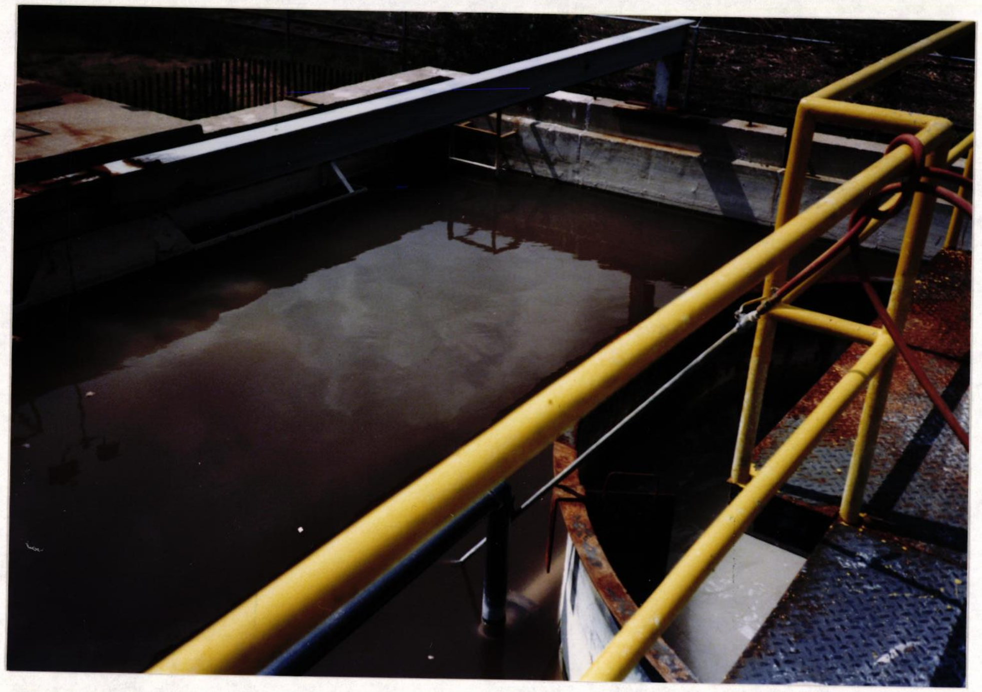
Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

photo863



PHOTOGRAPH # 9
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Settling basin interior

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1411

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

PHOTOGRAPH # 10
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Filter house sludge press

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1415

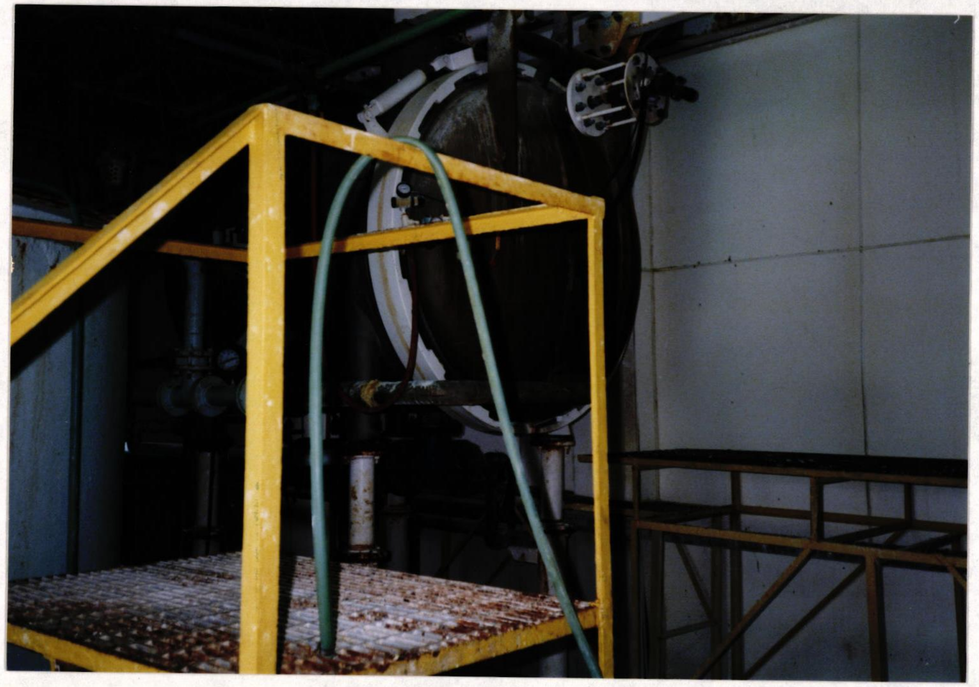
Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

photo863



PHOTOGRAPH # 11
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Filter house diatomaceous earth final effluent filter

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1417

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

PHOTOGRAPH # 12
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Filter house sludge conveyor belt and sludge bin

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1421

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

photo863

PHOTOGRAPH # 13
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Sludge hopper and canvas cover

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1440

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

PHOTOGRAPH # 14
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Sludge impoundment #3, note oily staining on impoundment sides

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1500

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

photo863

PHOTOGRAPH # 15
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Chemical storage area

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1028

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

PHOTOGRAPH # 16
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Receiving dock inside container storage area

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1012

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

photo863

PHOTOGRAPH # 17
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Chromic acid storage tank

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1447

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

PHOTOGRAPH # 18
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Nitric acid storage tank (left), HCl acid storage tank (right)

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1454

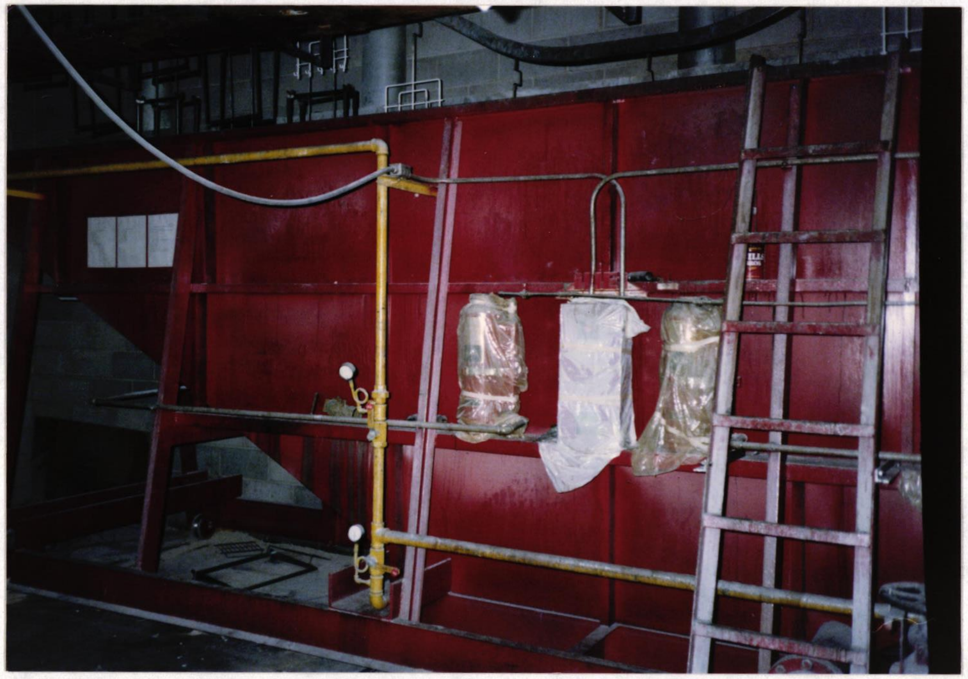
Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

photo863



PHOTOGRAPH # 19
OFFICIAL PHOTOGRAPH - JACOBS ENGINEERING

Subject: Epoxy lacquer tank

Location: Collis Inc., Clinton, Iowa

Date: 8-23-88 **Time:** 1107

Photographer: N. Bingert

Film: 35 mm 100 ASA

File: 05B86300

Witness: T. Hagen

APPENDIX 2

Source: [18]

LOG OF BORING NO. 13 (MW-13)

OWNER	ARCHITECT-ENGINEER
Collis, Inc.	
SITE	PROJECT NAME Phase 1, Part 2
Clinton, Iowa	Hydrogeological Monitoring Program

Sample No.	Type Sample	Sampling Distance	Recovery	Blows/ft.	Cation Exchange Capacity	Water Content-%	Dry Density lbs/ft³	Unified Class Symbol	Depth	Elevation	Description Top of Pipe Elevation 591.1 Surface Elevation 588.3	pH
1	ST	24	12		44.0	31.5					FILL: CONCRETE, CINDERS, AND SILT-LITTLE CLAY, TRACE SAND, ROOTS & GRAVEL Dark Brown	6.76
2	ST	24	7		23.7	20.0						6.97
3	ST	24							5	582.3	6.0'	
4	ST	24	8		20.4	22.1					SANDY CLAYEY SILT Dark Brown (Possible fill)	6.48
5	ST	24	6		37.5	29.1				578.3	10.0' (organics 8-10')	6.69
6	ST	24	6		36.1	17.4			10	576.3	SILTY CLAY-LITTLE SAND 12.0' Brown (Possible fill)	6.24
7	ST	24	17		24.9			CL			CLAYEY SILT-LITTLE SAND Gray to Red Gray	7.14
8	ST	24	16		11.0	24.1		CL	15			7.11
9	ST	24	15		23.4	24.3		CL			(Occasional sand seams)	7.38
10	ST	24	15		22.4			CL		569.0	19.3'	6.88
	HS											
11	SS	7	4		1.5				20	567.7	20.6' LIMESTONE HIGHLY WEATHERED Brown	7.45
									25		BOTTOM OF BORING Well Construction notes 2" SCH 40 PVC well screen 10' long set to 20.0 feet. Gravel pack 20.5 to 9.0 feet Bentonite 9.0 to 1.2 feet Cement Grout 1.2 to 0.0 feet Steel protector pipe installed	

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IN-SITU THE TRANSITION MAY BE GRADUAL.

WATER LEVEL OBSERVATIONS		
W.L. 3.0	W.S. OR W.D.	A.B.
W.L.	B.C.R.	A.C.R.
W.L.		

Terracon Consultants, Inc.
Cedar Falls Cedar Rapids Davenport
Des Moines Storm Lake, IA
Kansas City Wichita, KS
Omaha, NE
Oklahoma City Tulsa, OK

BORING STARTED 4-24-84	
BORING COMPLETED 4-24-84	
RIG BOMB	FOREMAN TAS
APPROVED JFH	JOB # 783606

Source: [18]

LOG OF BORING NO. 15 (B-15P)

OWNER	ARCHITECT-ENGINEER
Collis, Inc.	
SITE	PROJECT NAME Phase 1, Part 2
Clinton, Iowa	Hydrogeological Monitoring Program

Sample No.	Type Sample	Sampling Distance	Recovery	Blows/ft.	Cation Exchange Capacity	Water Content-%	Dry Density-lbs/ft 3	Unified Class Symbol	Depth	Elevation	Description: Top of Pipe Elevation 589.6; Surface Elevation 587.4	pH
1	ST	24	7		8.5	18.4		SM			SEE NOTE 1	
										583.9	3.5	7.75
	HS										SILTY CLAY TRACE SAND WITH OCCASIONAL SAND SEAMS	
2	SS	18			11.1 25.6	31.3 16.1		CL	5		Dark Gray	7.15
	HS									579.9	7.5'	6.41
3	SS	6		60/6"	1.8	7.8				578.8	(8.5) LIMESTONE-HIGHLY WEATHERED	6.07
									10		BOTTOM OF BORING	

NOTE 1:
FILL SILTY SAND WITH GRAVEL & CINDERS
Dark Gray and Brown

Oil observed from .5 to 3.5 ft.

Piezometer Point Construction Notes

2' Piezometer point set at 8.5'
Gravel pack 8.5 to 5.0'
Bentonite 5.0 to 0.0'

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IN-SITU, THE TRANSITION MAY BE GRADUAL

WATER LEVEL OBSERVATIONS			
W.L.	6 W.S. OR W.D.	A.B.	
W.L.	B.C.R.	A.C.R.	
W.L.			

Terracon Consultants, Inc.
Cedar Falls Cedar Rapids Davenport
Des Moines Storm Lake, IA
Kansas City Wichita, KS
Omaha, NE
Oklahoma City Tulsa, OK

BORING STARTED 4-25-84	
BORING COMPLETED 4-25-84	
RIG BOMB	FOREMAN TAS
APPROVED JFH	JOB # 783606

Source: [40]

WARZYN

LOG OF TEST BORING

Project Collis Inc.

Location Clinton, Iowa

Boring No. MW-20
Surface Elevation 588.0
Job No. 60123
Sheet 1 of 1

ONE SCIENCE COURT · P.O. BOX 5385, MADISON, WIS. 53705 · TEL.(608) 273-0440

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monoto
1		21	M	14		BERM FILL: Brown Sandy, Silty Clay, Trace Roots, Trace Gravel		0.0			
2		23	M	10		FILL: Brown Organic Rich Clay and Peat, Little Roots, Occasional Cinders, Glass Fragments, Red Brick Fragments, Gravel, Wood/Organic Fibers		0.0			
3		15	M/W	2	5			0.0			
4		15	W	2		Possible FILL: Brown Organic Rich Clayey Topsoil to Peat, Little Roots, Some Wood/Fibers		0.0			
5			W	0				0.0			
					10	End Boring at 9' Monitoring well installed. See separate detail sheet.					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ___ Upon Completion of Drilling ___
Time After Drilling ___
Depth to Water ___
Depth to Cave in ___

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 2/2/88 End 2/2/88
Driller ___ Chief RK Rig CME
Logger ___ Editor ___ 750
Drill Method 6 1/4" ID HSA

Source: [40]

WARZYN

LOG OF TEST BORING

Project: Collis Inc.

Location: Clinton, Iowa

Boring No. MW-21
Surface Elevation 587.1
Job No. 60123
Sheet 1 of 1

ONE SCIENCE COURT · P.O. BOX 5385, MADISON, WIS. 53705 · TEL.(608) 273-0440

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monoto
1		18	D/M	6		FILL: Black Organic-Rich Sandy Clay, Trace to Little Roots/Organic Fibers, Little Medium to Coarse Gravel, Cinders, Red Brick Fragments, Occasional 1-2" Sand Layers		0.0			
2		21	M	6				0.0			
3		10	M	2	5	Soft Green-Gray Silty CLAY, Trace Organics/Roots, Some Black Organic Stain (CL)		0.0			
4		10	W	1		Soft, Brown Sandy CLAY, Some Organic Fibers, Frequent Sandy Partings and 1" Layers of Sand		0.0			
5		10	W	1		Weathered LIMESTONE Bedrock					
					10	End Boring at 9.5' Monitoring well installed. See separate detail sheet.					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ ______ Upon Completion of Drilling ______
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 2/4/88 End 2/4/88
Driller ______ Chief RK Rig CME
Logger ______ Editor ______ 750
Drill Method 6 1/4" ID HSA

Source: [40]

WARZYN

LOG OF TEST BORING

Project Collis Inc.

Location Clinton, Iowa

Boring No. MW-22
Surface Elevation 588.8
Job No. 60123
Sheet 1 of 1

ONE SCIENCE COURT · P.O. BOX 5385, MADISON, WIS. 53705 · TEL.(608) 273-0440

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	HNu	Explosive Gas	Field VOC Water	Monoto
1		21	D/M	41		FILL: Medium to Coarse Gravel, Some Fine to Coarse Sand, Some Weathering of Stones (Mostly Carbonate, Occasional Siliceous Grains), Some Black Organic Stain, Occasional Cinder, Angular to Subangular		0.0			
2		22	M	20				0.0			
3		19	M	5	5	Black Organic Rich Clayey TOPSOIL, Trace Roots, Frequent Sandy Partings (Fill)		0.0			
4		12	W	0		FILL: Gray & Red Mottled Clay, Little to Some Sand, Alternating with Very Soft Red/Pink Sandy, Silty Clay (3-6" Layers), Some Wood Fibers/Organic Matter, Little Black Organic Stain		0.0			
5		14	W	118				0.0			
					10	Weathered LIMESTONE Bedrock					
						End Boring at 8.5'					
						Advance rig 6', blind drill to 7.5'. Set monitoring well at 7'. See separate detail sheet.					
					15						
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ ______ Upon Completion of Drilling ______
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 2/2/88 End 2/2/88
Driller ______ Chief RK Rig CME
Logger ______ Editor ______ 750
Drill Method 6 1/4" ID HSA

City of Clinton Water Supply Well

SYSTEM	SERIES	GROUP	FORMATN	MEMBER	DEPTH TOP	DEPTH BOT	ELEV. OF TOP	THICK-NESS	CONTACT SOURCE	ACCURACY TOP	ACCURACY BOT	LITHOLOGY PRIMARY	LITHOLOGY SECONDARY	LITHOLOGY MINOR
		GEOLOGICAL UNIT												

COUNTY: CLINTON SEQUENCE: 1
LOCATION: SE SE SW 11 T081N R06E LAT. & LONG.: 41 49 49N 90 13 48W W-NUMBER: 05220 DEPTH: 2202 ELEVATION: 591 (Alt.)

SYSTEM	SERIES	GROUP	FORMATN	MEMBER	TOP	BOT	ELEV. OF TOP	THICK-NESS	CONTACT SOURCE	ACCURACY TOP	ACCURACY BOT	PRIMARY	SECONDARY	MINOR
Quatern	Pleistoc	Holocene	Recent		0	20	591	20	Samples	good	good	Soil-fill		
		undiff			20	65	571	45	Samples	good	poor	Clay	Till	Sd & Grav
Silurian	--------	--------	Blanding		65	145	526	80	Samples	poor	good	Dolomite	Chert	
			Mosalem/		145	155	446	10	Samples	good	good	Dolomite		
Ordovicn	Cincinna	--------	Maquoket	Brainard	155	230	436	75	Samples	good	good	Shale	Dolomite	
				Ft Atkin	230	363	361	133	Samples	good	good	Shale	Dolomite	
				Elgin	363	380	228	17	Samples	good	good	Shale	Dolomite	
	Champlai	Galena	Dub./Wis		380	490	211	110	Samples	good	good	Dolomite	Chert	
			Dunleith		490	570	101	80	Samples	good	good	Dolomite	Chert	
			Decorah	Ion	570	600	21	30	Samples	good	good	Dolomite	Chert	Limestone
				Guttenbg	600	635	-9	35	Samples	good	good	Dolomite	Limestone	
		--------	Plattevl		635	720	-44	85	Samples	good	good	Limestone	Dolomite	Shale
		Ancell	Glenwood	Harmony	720	726	-129	6	Samples	good	good	Shale		
			St Peter		726	772	-135	46	Samples	good	good	Sandstone		
	Canadian	Prairie	Shakopee	Willow R	772	925	-181	153	Samples	good	poor	Dolomite	Sandstone	Chert
				New Rich	925	965	-334	40	Samples	poor	good	Dolomite	Sandstone	Chert
			Oneota		965	1130	-374	165	Samples	good	fair	Dolomite	Chert	Sandstone
Cambrian	St Croix	Trempeal	Jordan		1130	1203	-539	73	Samples	fair	good	Dolomite	Sandstone	Chert
			St Lawre		1203	1367	-612	164	Samples	good	good	Dolomite	Sandstone	Chert
		Tunnel C	LoneRock		1367	1540	-776	173	Samples	good	good	Sandstone	Dolomite	Shale
		ElkMound	Wonewoc	Ironton	1460	1540	-869	80	Samples	good	good	Sandstone	Dolomite	
			Gales./E		1540	2202*	-949	662*	Samples	good		Sandstone	Dolomite	Chert
			Wonewoc	Galesvil	1540	1605	-949	65	Samples	good	good	Sandstone		
			EauClair		1605	1870	-1014	265	Samples	good	good	Sandstone	Dolomite	Chert
			Mt Simon		1870	2202*	-1279	332*	Samples	good		Sandstone		

* ASTERISK SIGNIFIES PARTIAL PENETRATION

THIS DATA RETRIEVED FROM THE GSB AND USGS COOPERATIVE GEOLOGIC FILE (PHONE 319-335-1575).

Collis Inc. Water Supply Well

COUNTY: CLINTON SEQUENCE 10
LOCATION: NE SE NW 14 T081N R06E LAT. & LONG.: 41 49 33N 90 13 45W W-NUMBER: 13978 DEPTH: 1633 ELEVATION: 584 (Alt.)

			sample	gap	0	8	584	8						
Silurian	---------				8	160	576	152	Samples	poor	good	Dolomite	Chert	Shale
	---------	---------	Mosalem/		160	165	424	5	Samples	good	good	Dolomite	Chert	
Ordovicn	Cincinna	---------	Maquoket		165	375	419	210	Samples	good	good	Shale	Dolomite	
				Elgin	375	395	209	20	Samples	fair	good	Shale	Dolomite	
	Champlai	Galena	Dub./Wis		395	625	189	230	Samples	good	good	Dolomite		
			Decorah	Guttenbg	625	660	-41	35	Samples	good	fair	Dolomite		
		---------	Plattevl	McGregor	660	705	-76	45	Samples	poor	poor	Dolomite	Limestone	Chert
				Pecatoni	705	730	-121	25	Samples	fair	good	Dolomite	Limestone	
		Ancell	Glenwood	Harmony	730	738	-146	8	Samples	good	good	Shale		
			St Peter		738	798	-154	60	Samples	good	good	Limestone	Shale	
	Canadian	Prairie	Shakopee	Willow R	798	940	-214	142	Samples	good	good	Dolomite	Sandstone	Chert
				New Rich	940	980	-356	40	Samples	good	good	Dolomite	Sandstone	Chert
			Oneota		980	1160	-396	180	Samples	good	fair	Dolomite	Chert	
Cambrian	St Croix	Trempeal	Jordan		1160	1245	-576	85	Samples	poor	poor	Dolomite	Sandstone	Chert
			St Lawre		1245	1395	-661	150	Samples	fair	good	Dolomite	Sandstone	
		Tunnel C	LoneRock		1395	1550	-811	155	Samples	good	good	Sandstone	Dolomite	Shale
		ElkMound	Wonewoc	Ironton	1482	1550	-898	68	Samples	good	good	Sandstone		
			Gales./E		1550	1633*	-966	83*	Samples	good		Sandstone	Shale	
			Wonewoc	Galesvil	1550	1630	-966	80	Samples	good	good	Sandstone		
			EauClair		1630	1633*	-1046	3*	Samples	good		Sandstone	Shale	

* ASTERISK SIGNIFIES PARTIAL PENETRATION

THIS DATA RETRIEVED FROM THE GSB AND USGS COOPERATIVE GEOLOGIC FILE (PHONE 319-335-1575).

APPENDIX 3

3-1 Epoxy
Lacquer
Source: Supplied by Collis Inc.

*** MATERIAL SAFETY DATA SHEET ***

date of prep : 04/13/88 E850-C01 (page 1)

SECTION I

manufacturer : Sandstrom Products Co.
address : 224 South Main Street
Port Byron, Il. 61275

telephone# : (309) 523-2121
emergency# : (309) 523-2121

- H M I S -

HEALTH	: 2*
FLAMMABILITY	: 3
REACTIVITY	: 0
PERSONAL PROTECT.	: H

product class: EPOXY
mfg. code id : E850-C01
trade name : (8501) COLLIS CLEAR LACQUER

(HAZARD RATING : 0=least, 1=slight, 2=moderate, 3=high, 4=extreme, *=chronic)
(H = splash goggles, gloves, synthetic apron, & vapor respirator)

SECTION II-A HAZARDOUS COMPONENTS

no.	component	CAS#	vapor pressure (mm Hg @ 20 C)	LEL (@ 25 C)
1	1-METHOXY-2-PROPANOL	107-98-2	12.50 (@ 25 C)	1.60
2	TOLUENE	108-88-3	54.00 (@ 25 C)	1.40
3	BISPHENOL "A" EPOXY RESIN	25036-25-3	N/A	N/A
4	1-BUTANOL	71-36-3	4.00	1.40
5	XYLENE	1330-20-7	6.60	1.10
6	FORMALDEHYDE	50-00-0	1.00	7.00

Component number 6 is listed by NTP and IARC as a carcinogen or a possible carcinogen.
Refer to appropriate reference sources for additional information concerning carcinogens.

(N/A = not applicable)

SECTION II-B OCCUPATIONAL EXPOSURE LIMITS

	OSHA		ACGIH		MFG	
no.	PEL/TWA	PEL/CEILING	TLV/TWA	TLV/STEL	PEL/TWA	PEL/CEILING
1	N/E	N/E	100 ppm	150 ppm	N/E	N/E
2	200 ppm	300ppm	100 ppm	150 ppm	N/E	N/E
3	N/E	N/E	N/E	N/E	N/E	N/E
4	100 ppm	N/E	50 ppm CEILING (SKIN)	N/E	N/E	N/E
5	100 ppm	N/E	100 ppm	150 ppm	N/E	N/E
6	1ppm	2ppm	1ppm	2ppm	N/E	N/E

The dried film of this product may become a dust nuisance when removed by sanding or grinding. OSHA recommends a PEL/TWA of 15 mg/m3 for total dust and 5 mg/m3 for the respirable fraction. ACGIH recommends a TLV/TWA of 10 mg/m3 for total dust.
(SKIN) absorption may contribute to the overall exposure to this material. Take appropriate measures to prevent skin contact.

(N/E = not established)

SECTION III PHYSICAL DATA

boiling point : not established
evaporation rate : < 1 (ether = 1)
vapor density : > 1 (air = 1)

% volatile by volume : 80.33 +/- 2%
% volatile by weight : 73.77 +/- 2%
weight per gallon : 7.94 +/- .2

SECTION IV HEALTH INFORMATION

EYE CONTACT
BASED ON THE PRESENCE OF COMPONENTS 4 AND 6 PRODUCT IS PRESUMED TO BE SEVERELY IRRITATING TO THE EYES. EXPOSURE MAY CAUSE EXTENSIVE CORNEAL INJURY. BASED ON THE PRESENCE OF COMPONENTS 1, 2, 5 AND 6 PRODUCT VAPORS MAY ALSO BE IRRITATING TO THE EYES.

SKIN CONTACT
BASED ON THE PRESENCE OF COMPONENT 6 PRODUCT IS PRESUMED TO BE MODERATELY IRRITATING TO THE SKIN. PROLONGED CONTACT MAY CAUSE DAMAGE TO THIE SKIN. BASED ON THE PRESENCE OF COMPONENTS 1 AND 4 ABSORPTION THROUGH THE SKIN MAY RESULT IN SYMPTOMS OF EXPOSURE AS THOSE DESCRIBED FOR INHALATION AND INGESTION. BASED ON THE PRESENCE OF COMPONENTS 1, 2, 4 AND 5 PROLONGED OR REPEATED CONTACT MAY RESULT IN DEFATTING AND DRYING OF THE SKIN WHICH MAY RESULT IN DERMATITIS.

INHALATION
EXPOSURE MAY PRODUCE IRRITATION TO THE NOSE, THROAT, RESPIRATORY TRACT, AND OTHER MUCOUS MEMBRANES. BASED ON THE PRESENCE OF COMPONENTS 1, 2, 4 AND 5 EXPOSURE TO HIGH CONCENTRATIONS OF VAPOR MAY PRODUCE CENTRAL NERVOUS SYSTEM DEPRESSION. REPORTS HAVE ASSOCIATED REPEATED AND PROLONGED OCCUPATIONAL OVEREXPOSURE TO SOLVENTS WITH PERMANENT BRAIN AND NERVOUS SYSTEM DAMAGE. INTENTIONAL MISUSE BY DELIBERATELY CONCENTRATING AND INHALING THE CONTENTS MAY BE HARMFUL OR FATAL.

INGESTION
BASED ON THE PRESENCE OF COMPONENT 4 PRODUCT IS PRESUMED TO BE MODERATELY TOXIC. BASED ON THE PRESENCE OF COMPONENTS 2 AND 5 SMALL AMOUNTS OF THE LIQUID ASPIRATED INTO THE LUNGS DURING INGESTION OR FROM VOMITING MAY RESULT IN SEVERE LUNG DAMAGE. BASED ON THE PRESENCE OF COMPONENTS 1, 2, 4 AND 5 INGESTION MAY CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION. BASED ON THE PRESENCE OF COMPONENT 1 THIS PRODUCT MAY BE IRRITATING TO THE GASTROINTESTINAL TRACT IF INGESTED.

SIGNS AND SYMPTOMS
EYE, SKIN, RESPIRATORY, AND GASTRO-INTESTINAL IRRITATION AS NOTED ABOVE. BASED ON THE PRESENCE OF COMPONENTS 1, 2, 4 AND 5 CENTRAL NERVOUS SYSTEM DEPRESSION MAY BE EVIDENCED BY HEADACHE, DIZZINESS, NAUSEA AND SYMPTOMS OF INTOXICATION; IN EXTREME CASES UNCONSCIOUSNESS AND DEATH MAY OCCUR.

AGGRAVATED MEDICAL CONDITIONS
PREEXISTING SKIN, EYE AND RESPIRATORY DISORDERS MAY BE AGGRAVATED BY EXPOSURE TO THIS PRODUCT. IMPAIRED CENTRAL NERVOUS SYSTEM FUNCTIONS FROM PREEXISTING DISORDERS MAY BE AGGRAVATED BY EXPOSURE TO THIS PRODUCT.

OTHER HEALTH EFFECTS
BASED ON THE PRESENCE OF COMPONENT 6 PRODUCT IS PRESUMED TO BE CARCINOGENIC. BASED ON THE PRESENCE OF COMPONENT 1 CHRONIC OVEREXPOSURE MAY CAUSE INJURY TO THE KIDNEYS AND LIVER. BASED ON THE PRESENCE OF COMPONENT 4 CHRONIC EXPOSURE TO VAPOR CONCENTRATIONS ABOVE 50 PPM MAY RESULT IN SOME LOSS OF HEARING. BASED ON THE PRESENCE OF COMPONENT 1 CHRONIC OVEREXPOSURE MAY CAUSE DAMAGE TO THE LUNGS.

SECTION V EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT
IMMEDIATELY FLUSH EYES WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE HOLDING EYELIDS OPEN. SEEK PROMPT MEDICAL ATTENTION.

SKIN CONTACT
IMMEDIATELY REMOVE CONTAMINATED CLOTHING AND SHOES. WIPE EXCESS FROM SKIN AND FLUSH WITH WATER FOR AT LEAST 15 MINUTES USING SOAP IF AVAILABLE. SEEK PROMPT MEDICAL ATTENTION. DO NOT REUSE CLOTHING UNTIL THOROUGHLY DECONTAMINATED.

INHALATION
REMOVE VICTIM TO FRESH AIR AND TREAT SYMPTOMATICALLY. PROVIDE OXYGEN IF BREATHING IS DIFFICULT. GIVE ARTIFICIAL RESPIRATION IF THE VICTIM IS NOT BREATHING. SEEK PROMPT MEDICAL ATTENTION.

INGESTION
DO NOT INDUCE VOMITING. IF VOMITING SPONTANEOUSLY OCCURS, KEEP THE VICTIM'S HEAD BELOW THE HIPS TO PREVENT ASPIRATION INTO THE LUNGS. SINCE ASPIRATION INTO THE LUNGS CAN CAUSE VERY SERIOUS, PERMANENT DAMAGE, THE DECISION OF WHETHER TO INDUCE VOMITING OR NOT SHOULD BE MADE BY A PHYSICIAN. DANGER FROM LUNG ASPIRATION MUST BE WEIGHED AGAINST TOXICITY WHEN CONSIDERING EMPTYING THE STOMACH. CONSULT A PHYSICIAN, HOSPITAL OR POISON CONTROL CENTER AND/OR TRANSPORT TO AN EMERGENCY FACILITY IMMEDIATELY.

>> COMPONENTS 1 AND 4 ARE TOXIC AND THE PROPER FIRST AID IS TO INDUCE VOMITING.
>> COMPONENTS 2 AND 5 MAY CAUSE SEVERE, PERMANENT DAMAGE IF ASPIRATED AND VOMITING SHOULD NOT BE INDUCED.

SECTION VI — FIRE AND EXPLOSION HAZARDS

flammability classification - OSHA : FLAMMABLE LIQUID - CLASS IB
- DOT : FLAMMABLE LIQUID

flash point : 60 +/-2 degrees F. (PMCC)

EXTINGUISHING MEDIA
USE WATER FOG, FOAM, DRY CHEMICAL OR CARBON DIOXIDE.

SPECIAL FIRE FIGHTING PROCEDURES AND PRECAUTIONS
WARNING, FLAMMABLE. CLEAR FIRE AREA OF UNPROTECTED PERSONNEL. DO NOT ENTER CONFINED FIRE SPACE WITHOUT HELMET, FACE SHIELD, BUNKER COAT, GLOVES, RUBBER BOOTS, AND A POSITIVE PRESSURE NIOSH-APPROVED SELF-CONTAINED BREATHING APPARATUS.

UNUSUAL FIRE AND EXPLOSION HAZARDS
CONTAINERS EXPOSED TO INTENSE HEAT FROM FIRES SHOULD BE COOLED WITH WATER TO PREVENT VAPOR PRESSURE BUILDUP WHICH COULD RESULT IN CONTAINER RUPTURE. CONTAINER AREAS EXPOSED TO DIRECT FLAME CONTACT SHOULD BE COOLED WITH LARGE QUANTITIES OF WATER AS NEEDED TO PREVENT WEAKENING OF CONTAINER STRUCTURE.

SECTION VII — REACTIVITY

STABILITY : STABLE — HAZARDOUS POLYMERIZATION : MAY OCCUR

CONDITIONS AND MATERIALS TO AVOID
BASED ON THE PRESENCE OF COMPONENTS 1, 2, 4 AND 5 AVOID OXIDIZING MATERIALS. BASED ON THE PRESENCE OF COMPONENTS 4 AND 6 AVOID STRONG ACIDS. BASED ON THE PRESENCE OF COMPONENT 6 AVOID STRONG ALKALIES. BASED ON THE PRESENCE OF COMPONENT 6 AVOID ALKALIES AT HIGH TEMPERATURE.

HAZARDOUS DECOMPOSITION PRODUCTS
CARBON DIOXIDE, CARBON MONOXIDE AND UNIDENTIFIED ORGANIC COMPOUNDS MAY BE FORMED DURING COMBUSTION.

SECTION VIII — EMPLOYEE PROTECTION

RESPIRATORY PROTECTION
AVOID PROLONGED OR REPEATED BREATHING OF VAPORS. IF EXPOSURE EXCEEDS TLV USE A NIOSH-APPROVED RESPIRATOR TO PREVENT OVEREXPOSURE.

PROTECTIVE CLOTHING
AVOID CONTACT WITH EYES. WEAR GOGGLES IF THERE IS A LIKELIHOOD OF CONTACT WITH EYES. DO NOT GET ON SKIN OR ON CLOTHING.

ADDITIONAL PROTECTIVE MEASURES
USE VENTILATION AS REQUIRED TO CONTROL VAPOR CONCENTRATIONS. EYE WASH FOUNTAINS AND SAFETY SHOWERS SHOULD BE AVAILABLE FOR USE IN AN EMERGENCY.

SECTION IX ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURES

LARGE SPILLS >> EVACUATE THE HAZARD AREA OF UNPROTECTED PERSONNEL. WEAR APPROPRIATE RESPIRATOR AND PROTECTIVE CLOTHING. SHUT OFF SOURCE OF LEAK ONLY IF SAFE TO DO SO. DIKE AND CONTAIN. IF VAPOR CLOUD FORMS, WATER FOG MAY BE USED TO SUPPRESS; CONTAIN RUN-OFF. REMOVE WITH VACUUM TRUCKS OR PUMP TO STORAGE/SALVAGE VESSELS. SOAK UP RESIDUE WITH AN ABSORBENT SUCH AS CLAY, SAND OR OTHER SUITABLE MATERIAL; PLACE IN NON-LEAKING CONTAINERS FOR PROPER DISPOSAL. FLUSH AREA WITH WATER TO REMOVE TRACE RESIDUE; DISPOSE OF FLUSH SOLUTIONS AS ABOVE. SMALL SPILLS >> TAKE UP WITH AN ABSORBENT MATERIAL AND PLACE IN NON-LEAKING CONTAINERS; SEAL TIGHTLY FOR PROPER DISPOSAL.

WASTE DISPOSAL

REFER TO LATEST EPA OR STATE REGULATIONS REGARDING PROPER DISPOSAL.

SECTION X ADDITIONAL PRECAUTIONS

KEEP LIQUID AND VAPOR AWAY FROM HEAT, SPARKS, AND FLAME. EXTINGUISH PILOT LIGHTS, CIGARETTES AND TURN OFF OTHER POSSIBLE SOURCES OF IGNITION PRIOR TO USE AND UNTIL VAPORS ARE GONE. SURFACES THAT ARE SUFFICIENTLY HOT MAY IGNITE PRODUCT IN THE ABSENCE OF SPARKS OR FLAME. VAPORS MAY ACCUMULATE AND TRAVEL TO IGNITION SOURCES DISTANT FROM HANDLING SITE. KEEP CONTAINERS CLOSED WHEN NOT IN USE. USE WITH ADEQUATE VENTILATION. CONTAINERS, EVEN IF EMPTY, CAN CONTAIN EXPLOSIVE VAPORS. DO NOT CUT, DRILL, GRIND, OR WELD NEAR CONTAINERS.

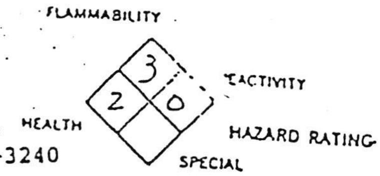
CONTAINERS CAN CONTAIN HAZARDOUS PRODUCT RESIDUES EVEN WHEN EMPTY. WASH WITH SOAP AND WATER BEFORE EATING, DRINKING, SMOKING, OR USING TOILET FACILITIES.

3-2 Epoxy Thinner
Source: [32]

MATERIAL SAFETY DATA SHEET

APPROVED BY U S DEPT OF LABOR, ESSENTIALLY SIMILAR TO FORM OSHA 20

BARTON SOLVENTS, INC.
CORPORATE OFFICE
P. O. BOX 221
DES MOINES, IOWA 50301
EMERGENCY PHONE: 515 265-7998



CHEMICAL NAME & SYNONYMS: Solvent TRADE NAME: Barsol A-3240
CHEMICAL FAMILY: n/a
FORMULA: n/a

I. PHYSICAL DATA

BOILING RANGE: 82 137 158°C / 179 279 317°F
API GRAVITY: n/a
SPECIFIC GRAVITY (WATER=1): 0.881
POUNDS/GALLON: 7.339
VAPOR PRESSURE(mm of Hg)@20°C: 21.1
VAPOR DENSITY(air=1): 3.3
SOLUBILITY IN WATER: Appreciable
SOLUBILITY IN ACID(85% H_2SO_4): Appreciable
DRY TIME(Ether=1): 18.2
% VOLATILE BY VOL: 100
APPEARANCE: Clear, Water-White
ODOR: Aromatic

II. HAZARDOUS INGREDIENTS

TERIAL	CAS#	VOL (%)	TLV (ppm)
lol	1330-20-7	> 9	100
Propylene Glycol Methyl Ether Acetate	108-65-6	> 9	100
Ethanol	46-17-5	> 9	1000
Dipropylene Glycol Methyl Ether Acetate	88917-22-0	> 1	100

III. FIRE & EXPLOSION HAZARD DATA

LOWER FLAMMABLE LIMIT IN AIR(% BY VOL): 1.2
FLASH POINT(TEST METHOD): 21°C / 70°F (TCC)
FLAMMABILITY CLASSIFICATION: Class I B
EXTINGUISHING MEDIA: NFPA Class B extinguishers (CO_2 or foam) for Class I B liquid fires.
SPECIAL FIRE FIGHTING PROCEDURES: Water spray may be ineffective on fire but can protect fire fighters & cool closed containers. Use fog nozzles if water is used. Use air-supplied breathing masks.
UNUSUAL EXPLOSION AND FIRE PROCEDURES: FLAMMABLE!! Keep container tightly closed. Isolate from oxidizers, heat, sparks, electric equipment & open flame. Closed containers may explode if exposed to extreme heat. Applying to hot surfaces requires special precautions.

IV. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: 45 ppm (Evaporated Blend)

EFFECTS OF ACUTE OVER-EXPOSURE:	INHALING: Anesthetic. Irritates respiratory tract. May cause serious nervous system depression. SKIN OR EYE CONTACTC: Primary irritation.
EFFECTS OF SWALLOW-ING AND CHRONIC OVER-EXPOSURE:	Vapor harmful. Breathing of vapor may cause irritation. Liquid may cause skin irritation. Harmful or fatal if swallowed. Laboratory studies of 2-Ethoxyethanol Acetate have shown birth defects, increased fetal lethality, and delayed fetal development in offspring of female animals exposed during pregnancy with threshold levels approximately 400 ppm concentration in air.
EMERGENCY & FIRST AID PROCEDURES:	In case of contact with skin, flush with plenty of water. For eyes, flush with plenty of water for 15 minutes & get medical attention. If exposed to high concentration of vapor, remove to fresh air. If swallowed, CALL A PHYSICIAN IMMEDIATELY! Do NOT induce vomiting.

V. REACTIVITY DATA

STABILITY: Stable

CONDITIONS TO AVOID: Isolate from heat, sparks, electric equipment & open flame.

INCOMPATABILITY: Isolate from strong oxidizers such as permanganate.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon Monoxide from burning.

VI. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF SPILLED OR RELEASED:	Isolate from oxidizers, heat, sparks, electric equipment & open flame. Mop up & dispose of.
WASTE DISPOSAL METHOD:	Recycle or incinerate observing local,s tate & Federal health, safety & pollution laws.

VII. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION: None

VENTILATION: LOCAL EXHAUST: Preferable — MECHANICAL(GENERAL): Acceptable

SPECIAL: None — OTHER: None

PROTECTIVE GLOVES: Recommended (Must not dissolve in solvents)

EYE PROTECTION: Required

OTHER PROTECTION: None

VIII. SPECIAL PRECAUTIONS

Do not store above 49°C/120°F. Store large amounts in structures made for OSHA Class I B liquids. Avoid free fall of liquid. Ground continers when pouring. Do not flame cut, saw, braze or weld. Empty container hazardous! Continue all label precautions!

DATE: 5 / 85

11/85

4-86

3-3 Epoxy Powder
Source: Supplied by Collis Inc.

MATERIAL SAFETY DATA SHEET

THE GLIDDEN COMPANY

925 EUCLID AVENUE
CLEVELAND, OHIO 44115
EMERGENCY TELEPHONE NO. (216) 826-5566

COMPLIES WITH OSHA HAZARD COMMUNICATION STANDARD 29CFR1910.1200.

SECTION I

CODE IDENTIFICATION	2W149	DATE PRINTED	03/31/88
PRODUCT IDENTIFICATION	EPOXY	BASIC POWDER COATINGS	

SECTION II HAZARDOUS INGREDIENTS

HAZARDOUS INGREDIENTS CHEM/COMMON(CAS NO)	RANGE	ACGIH TLV-TWA	ACGIH TLV-STEL	OSHA PEL 8 Hr. TWA
CALCIUM CARBONATE SAME (471-34-1)	5 TO 10%	10 mg/m3		15 mg/m3
TITANIUM DIOXIDE SAME (13463-67-7)	>40%	10 mg/m3		15 mg/m3

(1) SUPPLIER RECOMMENDED EXPOSURE LIMIT

MATERIAL SAFETY DATA SHEET

THE GLIDDEN COMPANY

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COMPLIES WITH OSHA HAZARD COMMUNICATION STANDARD 29CFR1910.1200.

CODE IDENTIFICATION 2W149 DATE PRINTED 03/31/88

SECTION III PHYSICAL DATA

BOILING RANGE NOT APPLICABLE
% VOLATILE BY VOLUME <0.5
SPECIFIC GRAVITY +/-0.05 1.77

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (SETA): NOT APPLICABLE
LOWER EXPLOSION LIMIT: NOT DETERMINED
DOT (PSN): PLASTIC RELATED MATERIALS
HAZARD CLASS: NOT RESTRICTED
EXTINGUISHING MEDIA: SAND OR GROUND LIMESTONE, WATER FOG OR FOAM
UNUSUAL FIRE AND EXPLOSION HAZARDS:
DUST EXPLOSION HAZARD CONSULT NFPA 33 FOR PROPER HANDLING DURING APPLICATION
SPECIAL FIREFIGHTING PROCEDURE: NONE

SECTION V HEALTH HAZARD

ROUTE OF ENTRY: INHALATION
SKIN
EYES
INGESTION

EFFECTS OF OVEREXPOSURE:
IRRITATION OF EYES, SKIN, RESPIRATORY TRACT. PROLONGED INHALATION MAY LEAD TO RESPIRATORY PROBLEMS. PROLONGED OR REPEATED CONTACT CAN CAUSE DERMATITIS.

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION: MOVE PERSON TO WELL VENTILATED AREA. CONSULT A PHYSICIAN. ADMINISTER OXYGEN OR ARTIFICIAL RESPIRATION, IF NECESSARY

SKIN CONTACT: FLUSH FROM SKIN WITH WATER. THEN WASH THOROUGHLY WITH SOAP AND WATER

EYE CONTACT: FLUSH IMMEDIATELY WITH LARGE AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. CONSULT A PHYSICIAN

MATERIAL SAFETY DATA SHEET

THE GLIDDEN COMPANY

925 EUCLID AVENUE
CLEVELAND, OHIO 44115
EMERGENCY TELEPHONE NO. (216) 826-5566

COMPLIES WITH OSHA HAZARD COMMUNICATION STANDARD 29CFR1910.1200.

CODE IDENTIFICATION 2W149 DATE PRINTED 03/31/88

SECTION V HEALTH HAZARD CONTINUED

INGESTION: CONSULT A PHYSICIAN

SECTION VI REACTIVITY DATA

STABILITY: STABLE

INCOMPATIBILITY: NOT DETERMINED

CONDITIONS TO AVOID: ELEVATED TEMPERATURES ABOVE DECOMPOSITION RANGE

HAZARDOUS DECOMPOSITION PROPERTIES:
AS WITH ANY ORGANIC MATERIAL, CARBON MONOXIDE, CARBON DIOXIDE, AND MISCELLANEOUS AROMATIC AND ALIPHATIC HYDROCARBON MAY BE EMITTED UPON THERMAL DECOMPOSITION.

HAZARDOUS POLYMERIZATION:WILL NOT OCCUR

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
ELIMINATE ALL SOURCES OF IGNITION
VENTILATE AREA
VACUUM CLEAN SPILLAGE
PREVENT AIRBORNE PARTICULATES FROM FORMING

WASTE DISPOSAL: DISPOSE IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS

MATERIAL SAFETY DATA SHEET

THE GLIDDEN COMPANY

925 EUCLID AVENUE
CLEVELAND, OHIO 44115
EMERGENCY TELEPHONE NO. (216) 826-5566

COMPLIES WITH OSHA HAZARD COMMUNICATION STANDARD 29CFR1910.1200.

CODE IDENTIFICATION 2W149 DATE PRINTED 03/31/88

SECTION VIII SPECIAL PROTECTION INFORMATION

SINCE ALL POWDER COATINGS ARE CONSIDERED AT LEAST NUISANCE DUST, CONTROL ENVIRONMENTAL CONCENTRATIONS BELOW APPLICABLE STANDARDS. WHERE RESPIRATORY PROTECTION IS REQUIRED, USE ONLY NIOSH/MSHA APPROVED RESPIRATORS IN ACCORDANCE WITH OSHA STANDARD 29 CFR 1910.134

VENTILATION: PROVIDE VENTILATION OR LOCAL EXHAUST TO PREVENT DUST ACCUMULATION. USE EXPLOSION-PROOF EQUIPMENT.

PERSONAL PROTECTIVE EQUIPMENT:
EYE WASH
SAFETY SHOES
SAFETY GLASSES OR GOGGLES
IMPERVIOUS GLOVES

SECTION IX SPECIAL PRECAUTIONS

HANDLING AND STORAGE:
TO MAXIMIZE SHELF LIFE STORE BELOW 80 F

OTHER PRECAUTIONS: USE ONLY WITH ADEQUATE VENTILATION.
DO NOT TAKE INTERNALLY.
KEEP OUT OF REACH OF CHILDREN.
AVOID CONTACT WITH SKIN AND EYES, AND BREATHING OF DUST.
WASH HANDS THOROUGHLY AFTER HANDLING, ESPECIALLY BEFORE EATING OR SMOKING.
KEEP CONTAINERS TIGHTLY CLOSED AND UPRIGHT WHEN NOT IN USE.

3-4 Settling
Basin Flocculant
Source: Supplied by Collis Inc.

72-62-7830-01

Material Safety Data Sheet

Drew Industrial Division
ASHLAND CHEMICAL COMPANY, DIV ASHLAND OIL INC.
One Drew Plaza, Boonton, New Jersey 07005
Phone (201) 263-7600/Telex 136444
24-HOUR EMERGENCY TELEPHONE 606/324-1133

THIS MSDS COMPLIES WITH 29 CFR 1910.1200 (THE HAZARD COMMUNICATION STANDARD)

PRODUCT NAME: DREWFLOC(R) 270 FLOCCULANT

COLLIS INCORPORATED
2005 SOUTH 19TH STREET
CLINTON IA52732

OD 10 145 18406-074
DATA SHEET NO: 0175927-001
LATEST REVISION DATE: 02/86-86052
PRODUCT: 542112B
INVOICE: 322604
INVOICE DATE: 09/18/87
TO: COLLIS INCORPORATED
2005 SOUTH 19TH STREET
CLINTON IA52732

SECTION I-PRODUCT IDENTIFICATION

GENERAL OR GENERIC ID: FLOCCULANT

DOT HAZARD CLASSIFICATION: NOT APPLICABLE

SECTION II-COMPONENTS

IF PRESENT, IARC, NTP AND OSHA CARCINOGENS ARE IDENTIFIED IN THIS SECTION
SEE DEFINITION PAGE FOR CLARIFICATION

INGREDIENT	% (BY WT)	NOTE
ACRYLIC POLYMER *	85-100	(1)

(1): PEL/TLV NOT ESTABLISHED FOR THIS MATERIAL

* THE SPECIFIC CHEMICAL IDENTITY HAS BEEN WITHHELD AS A TRADE SECRET.

SECTION III-PHYSICAL DATA

PROPERTY	REFINEMENT	MEASUREMENT
BOILING POINT	NOT APPLICABLE	
VAPOR PRESSURE	NOT APPLICABLE	
SPECIFIC VAPOR DENSITY	NOT APPLICABLE	
SPECIFIC GRAVITY	UNAVAILABLE	
PERCENT VOLATILES		5-10%
EVAPORATION RATE	NOT APPLICABLE	
APPEARANCE		WHITE, FINE
STATE		SOLID
FORM		POWDER

SECTION IV-FIRE AND EXPLOSION INFORMATION

FLASH POINT NOT APPLICABLE

EXPLOSIVE LIMIT NOT APPLICABLE

EXTINGUISHING MEDIA: CARBON DIOXIDE

HAZARDOUS DECOMPOSITION PRODUCTS: THERMAL DECOMPOSITION OR COMBUSTION MAY PRODUCE:, CARBON MONOXIDE, CARBON DIOXIDE, AMMONIA, AND/OR, OXIDES OF NITROGEN

FIREFIGHTING PROCEDURES: WEAR SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE AND FULL BODY PROTECTIVE CLOTHING WHEN FIGHTING FIRES.

SPECIAL FIRE & EXPLOSION HAZARDS: DUST MAY BE AN EXPLOSION HAZARD.

SECTION V-HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE LEVEL: NOT ESTABLISHED FOR PRODUCT. SEE SECTION II.

EFFECTS OF ACUTE OVEREXPOSURE: FOR PRODUCT

EYES - MAY CAUSE IRRITATION.
SKIN - MAY CAUSE IRRITATION.
BREATHING - OF DUST CAN CAUSE IRRITATION OF NASAL AND RESPIRATORY PASSAGES.
SWALLOWING - MAY CAUSE GASTROINTESTINAL IRRITATION.

FIRST AID:

IF ON SKIN: THOROUGHLY WASH EXPOSED AREA WITH SOAP AND WATER.

IF IN EYES: FLUSH WITH LARGE AMOUNTS OF WATER, LIFTING UPPER AND LOWER LIDS OCCASIONALLY.

72-62-7830-01

Material Safety Data Sheet

Drew Industrial Division
ASHLAND CHEMICAL COMPANY, DIV. ASHLAND OIL, INC.
One Drew Plaza, Boonton, New Jersey 07005
Phone (201) 263-7600/Telex 136444
24-HOUR EMERGENCY TELEPHONE 606/324-1133

DEFINITIONS

THIS DEFINITION PAGE IS INTENDED FOR USE WITH MATERIAL SAFETY DATA SHEETS SUPPLIED BY THE DREW CHEMICAL CORPORATION. RECIPIENTS OF THESE DATA SEETS SHOULD CONSULT THE OSHA SAFETY AND HEALTH STANDARDS (29 CFR 1910), PARTICULARLY SUBPART G - OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL, AND SUBPART I - PERSONAL PROTECTIVE EQUIPMENT, FOR GENERAL GUIDANCE ON CONTROL OF POTENTIAL OCCUPATIONAL HEALTH AND SAFETY HAZARDS.

SECTION I
PRODUCT IDENTIFICATION

GENERAL OR GENERIC ID: CHEMICAL FAMILY OR PRODUCT DESCRIPTION.

DOT HAZARD CLASSIFICATION: PRODUCT MEETS DOT CRITERIA FOR HAZARDS LISTED.

SECTION II
COMPONENTS

COMPONENTS ARE LISTED IN THIS SECTION IF THEY PRESENT A PHYSICAL OR HEALTH HAZARD AND ARE PRESENT AT OR ABOVE 1% IN THE MIXTURE. IF A COMPONENT IS IDENTIFIED AS A CARCINOGEN BY NTP, IARC OR OSHA AS OF THE DATE ON THE MSDS, IT WILL BE LISTED AND FOOTNOTED IN THIS SECTION WHEN PRESENT AT OR ABOVE 0.1% IN THE PRODUCT. NEGATIVE CONCLUSIONS CONCERNING CARCINOGENICITY ARE NOT REPORTED. ADDITIONAL INFORMATION MAY BE FOUND IN SECTION V. OTHER COMPONENTS MAY BE LISTED IF DEEMED APPROPRIATE.

IDENTITIES OF COMPONENTS LISTED GENERICALLY ARE DECLARED TRADE SECRET.

EXPOSURE RECOMMENDATIONS ARE FOR COMPONENTS. OSHA PERMISSIBLE EXPOSURE LIMITS (PELS) AND AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH) THRESHOLD LIMIT VALUES (TLVS) APPEAR ON THE LINE WITH THE COMPONENT IDENTIFICATION. OTHER RECOMMENDATIONS APPEAR AS FOOTNOTES.

SECTION III
PHYSICAL DATA

BOILING POINT: OF PRODUCT IF KNOWN. THE LOWEST VALUE OF THE COMPONENTS IS LISTED FOR MIXTURES.

VAPOR PRESSURE: OF PRODUCT IF KNOWN. THE HIGHEST VALUE OF THE COMPONENTS IS LISTED FOR MIXTURES.

SPECIFIC VAPOR DENSITY: COMPARED TO AIR = 1. IF SPECIFIC VAPOR DENSITY OF PRODUCT IS NOT KNOWN, THE VALUE IS EXPRESSED AS LIGHTER OR HEAVIER THAN AIR.

SPECIFIC GRAVITY: COMPARED TO WATER = 1. IF SPECIFIC GRAVITY OF PRODUCT IS NOT KNOWN, THE VALUE IS EXPRESSED AS LESS THAN OR GREATER THAN WATER.

PH: IF APPLICABLE.

PERCENT VOLATILES: PERCENTAGE OF MATERIAL WITH INITIAL BOILING POINT BELOW 425 DEGREES FAHRENHEIT.

EVAPORATION RATE: INDICATED AS FASTER OR SLOWER THAN ETHYL ETHER, UNLESS OTHERWISE STATED.

SECTION IV
FIRE AND EXPLOSION INFORMATION

FLASH POINT: METHOD IDENTIFIED.

EXPLOSION LIMITS: FOR PRODUCT IF KNOWN. THE LOWEST VALUE OF THE COMPONENTS IS LISTED FOR MIXTURES.

HAZARDOUS DECOMPOSITION PRODUCTS: KNOWN OR EXPECTED HAZARDOUS PRODUCTS RESULTING FROM HEATING, BURNING, OR OTHER REACTIONS.

SECTION IV (CONT.)

EXTINGUISHING MEDIA: FOLLOWING NATIONAL FIRE PROTECTION ASSOCIATION CRITERIA.

FIREFIGHTING PROCEDURES: MINIMUM EQUIPMENT TO PROTECT FIREFIGHTERS FROM TOXIC PRODUCTS OF VAPORIZATION, COMBUSTION OR DECOMPOSITION IN FIRE SITUATIONS. OTHER FIREFIGHTING HAZARDS MAY ALSO BE INDICATED.

SPECIAL FIRE AND EXPLOSION HAZARDS: STATES HAZARDS NOT COVERED BY OTHER SECTIONS.

NFPA CODES: HAZARD RATINGS ASSIGNED BY THE NATIONAL FIRE PROTECTION ASSOCIATION.

SECTION V
HEALTH HAZARD DATA

PERMISSIBLE EXPOSURE LIMIT: FOR PRODUCT.

THRESHOLD LIMIT VALUE: FOR PRODUCT.

EFFECTS OF ACUTE OVEREXPOSURE: POTENTIAL LOCAL AND SYSTEMIC EFFECTS DUE TO SINGLE OR SHORT TERM OVEREXPOSURE TO THE EYES AND SKIN OR THROUGH INHALATION OR INGESTION.

EFFECTS OF CHRONIC OVEREXPOSURE: POTENTIAL LOCAL AND SYSTEMIC EFFECTS DUE TO REPEATED OR LONG TERM OVEREXPOSURE TO THE EYES AND SKIN OR THROUGH INHALATION OR INGESTION.

FIRST AID: PROCEDURES TO BE FOLLOWED WHEN DEALING WITH ACCIDENTAL OVEREXPOSURES.

PRIMARY ROUTE OF ENTRY: BASED ON PROPERTIES AND EXPECTED USE.

SECTION VI
REACTIVITY DATA

HAZARDOUS POLYMERIZATION: CONDITIONS TO AVOID TO PREVENT HAZARDOUS POLYMERIZATION RESULTING IN A LARGE RELEASE OF ENERGY.

STABILITY: CONDITIONS TO AVOID TO PREVENT HAZARDOUS OR VIOLENT DECOMPOSITION.

INCOMPATIBILITY: MATERIALS AND CONDITIONS TO AVOID TO PREVENT HAZARDOUS REACTIONS.

SECTION VII
SPILL OR LEAK PROCEDURES

REASONABLE PRECAUTIONS TO BE TAKEN AND METHODS OF CONTAINMENT, CLEAN-UP AND DISPOSAL. CONSULT FEDERAL, STATE AND LOCAL REGULATIONS FOR ACCEPTED PROCEDURES AND ANY REPORTING OR NOTIFICATION REQUIREMENTS.

SECTION VIII
PROTECTIVE EQUIPMENT TO BE USED

PROTECTIVE EQUIPMENT WHICH MAY BE NEEDED WHEN HANDLING THE PRODUCT.

SECTION IX
SPECIAL PRECAUTIONS OR OTHER COMMENTS

COVERS ANY RELEVANT POINTS NOT PREVIOUSLY MENTIONED.

ADDITIONAL COMMENTS

CONTAINERS SHOULD BE EITHER RECONDITIONED BY CERTIFIED FIRMS OR PROPERLY DISPOSED OF BY APPROVED FIRMS. DISPOSAL OF CONTAINERS SHOULD BE IN ACCORDANCE WITH APPLICABLE LAWS AND REGULATIONS. "EMPTY" DRUMS SHOULD NOT BE GIVEN TO INDIVIDUALS. SERIOUS ACCIDENTS HAVE RESULTED FROM THE MISUSE OF "EMPTIED" CONTAINERS (DRUMS, PAILS, ETC.). REFER TO SECTIONS IV AND IX.

72-62-7830-01

Material Safety Data Sheet

Drew Industrial Division

ASHLAND CHEMICAL COMPANY, DIV. ASHLAND OIL INC.
One Drew Plaza, Boonton, New Jersey 07005
Phone (201) 263-7600/Telex 136444
24-HOUR EMERGENCY TELEPHONE 606/324-1133

SECTION V-HEALTH HAZARD DATA (CONTINUED)

IF SWALLOWED: IMMEDIATELY DRINK TWO GLASSES OF WATER AND INDUCE VOMITING BY EITHER GIVING IPECAC SYRUP OR BY PLACING FINGER AT BACK OF THROAT. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. GET MEDICAL ATTENTION IMMEDIATELY.

IF BREATHED: REMOVE INDIVIDUAL TO FRESH AIR.

PRIMARY ROUTE(S) OF ENTRY:

SKIN CONTACT

SECTION VI-REACTIVITY DATA

HAZARDOUS POLYMERIZATION: CANNOT OCCUR

STABILITY: STABLE -- AVOID HEAT, OPEN FLAME, AND PROLONGED STORAGE AT ELEVATED TEMPERATURES.

INCOMPATIBILITY: AVOID CONTACT WITH:, STRONG ALKALIES., STRONG MINERAL ACIDS., STRONG OXIDIZING AGENTS., N-NITROSAMINES

SECTION VII-SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

SMALL SPILL: SWEEP UP MATERIAL ONTO PAPER.

LARGE SPILL: SHOVEL MATERIAL INTO CONTAINERS. THOROUGHLY SWEEP AREA OF SPILL TO CLEAN UP ANY RESIDUAL MATERIAL.
THE AREA SHOULD BE THOROUGHLY FLUSHED WITH WATER AND SCRUBBED TO REMOVE RESIDUE. IF SLIPPERINESS REMAINS APPLY MORE DRY-SWEEPING COMPOUND.
PREVENT RUN-OFF TO SEWERS, STREAMS OR OTHER BODIES OF WATER. IF RUN-OFF OCCURS, NOTIFY PROPER AUTHORITIES AS REQUIRED, THAT A SPILL HAS OCCURED.

WASTE DISPOSAL METHOD:

SMALL SPILL: DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

LARGE SPILL: DISPOSE OF IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

SECTION VIII-PROTECTIVE EQUIPMENT TO BE USED

RESPIRATORY PROTECTION: IF NEEDED USE A NIOSH/MSHA JOINTLY APPROVED DUST RESPIRATOR.(ASK YOUR SAFETY EQUIPMENT SUPPLIER)

VENTILATION: PROVIDE SUFFICIENT MECHANICAL (GENERAL AND/OR LOCAL EXHAUST) VENTILATION TO MAINTAIN EXPOSURE BELOW LEVEL OF OVEREXPOSURE (FROM KNOWN, SUSPECTED OR APPARENT ADVERSE EFFECTS).

PROTECTIVE GLOVES: WEAR RESISTANT GLOVES SUCH AS:, NITRILE RUBBER

EYE PROTECTION: CHEMICAL SPLASH GOGGLES IN COMPLIANCE WITH OSHA REGULATIONS ARE ADVISED; HOWEVER, OSHA REGULATIONS ALSO PERMIT OTHER TYPE SAFETY GLASSES. (CONSULT YOUR SAFETY EQUIPMENT SUPPLIER)

OTHER PROTECTIVE EQUIPMENT: TO PREVENT SKIN CONTACT, WEAR IMPERVIOUS CLOTHING AND BOOTS.

SECTION IX-SPECIAL PRECAUTIONS OR OTHER COMMENTS

CONTAINERS OF THIS MATERIAL MAY BE HAZARDOUS WHEN EMPTIED. SINCE EMPTIED CONTAINERS RETAIN PRODUCT RESIDUES (VAPOR, LIQUID, AND/OR SOLID), ALL HAZARD PRECAUTIONS GIVEN IN THIS DATASHEET MUST BE OBSERVED.

AVOID CONTACT WITH WATER. THIS MATERIAL IS SLIPPERY WHEN WET.

THE INFORMATION ACCUMULATED HEREIN IS BELIEVED TO BE ACCURATE BUT IS NOT WARRANTED TO BE WHETHER ORIGINATING WITH THE COMPANY OR NOT. RECIPIENTS ARE ADVISED TO CONFIRM IN ADVANCE OF NEED THAT THE INFORMATION IS CURRENT, APPLICABLE, AND SUITABLE TO THEIR CIRCUMSTANCES.